Adapting to Change: Labour Market Adjustment in Canada

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Adapting to Change: Labour Market Adjustment in Canada

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Foreword

When the members of the Rowell-Sirois Commission began their collective task in 1937, very little was known about the evolution of the Canadian economy. What was known, moreover, had not been extensively analyzed by the slender cadre of social scientists of the day.

When we set out upon our task nearly 50 years later, we enjoyed a substantial advantage over our predecessors; we had a wealth of information. We inherited the work of scholars at universities across Canada and we had the benefit of the work of experts from private research institutes and publicly sponsored organizations such as the Ontario Economic Council and the Economic Council of Canada. Although there were still important gaps, our problem was not a shortage of information; it was to interrelate and integrate — to synthesize — the results of much of the information we already had.

The mandate of this Commission is unusually broad. It encompasses many of the fundamental policy issues expected to confront the people of Canada and their governments for the next several decades. The nature of the mandate also identified, in advance, the subject matter for much of the research and suggested the scope of enquiry and the need for vigorous efforts to interrelate and integrate the research disciplines. The resulting research program, therefore, is particularly noteworthy in three respects: along with original research studies, it includes survey papers which synthesize work already done in specialized fields; it avoids duplication of work which, in the judgment of the Canadian research community, has already been well done; and, considered as a whole, it is the most thorough examination of the Canadian economic, political and legal systems ever undertaken by an independent agency.

The Commission's research program was carried out under the joint

direction of three prominent and highly respected Canadian scholars: Dr. Ivan Bernier (*Law and Constitutional Issues*), Dr. Alan Cairns (*Politics and Institutions of Government*) and Dr. David C. Smith (*Economics*).

Dr. Ivan Bernier is Dean of the Faculty of Law at Laval University. Dr. Alan Cairns is former Head of the Department of Political Science at the University of British Columbia and, prior to joining the Commission, was William Lyon Mackenzie King Visiting Professor of Canadian Studies at Harvard University. Dr. David C. Smith, former Head of the Department of Economics at Queen's University in Kingston, is now Principal of that University. When Dr. Smith assumed his new responsibilities at Queen's in September 1984, he was succeeded by Dr. Kenneth Norrie of the University of Alberta and John Sargent of the federal Department of Finance, who together acted as Co-directors of Research for the concluding phase of the Economics research program.

I am confident that the efforts of the Research Directors, research coordinators and authors whose work appears in this and other volumes, have provided the community of Canadian scholars and policy makers with a series of publications that will continue to be of value for many years to come. And I hope that the value of the research program to Canadian scholarship will be enhanced by the fact that Commission research is being made available to interested readers in both English and French.

I extend my personal thanks, and that of my fellow Commissioners, to the Research Directors and those immediately associated with them in the Commission's research program. I also want to thank the members of the many research advisory groups whose counsel contributed so substantially to this undertaking.

DONALD S. MACDONALD

INTRODUCTION

At its most general level, the Royal Commission's research program has examined how the Canadian political economy can better adapt to change. As a basis of enquiry, this question reflects our belief that the future will always take us partly by surprise. Our political, legal and economic institutions should therefore be flexible enough to accommodate surprises and yet solid enough to ensure that they help us meet our future goals. This theme of an adaptive political economy led us to explore the interdependencies between political, legal and economic systems and drew our research efforts in an interdisciplinary direction.

The sheer magnitude of the research output (more than 280 separate studies in 70+ volumes) as well as its disciplinary and ideological diversity have, however, made complete integration impossible and, we have concluded, undesirable. The research output as a whole brings varying perspectives and methodologies to the study of common problems and we therefore urge readers to look beyond their particular field of interest and to explore topics across disciplines.

The three research areas, — *Law and Constitutional Issues*, under Ivan Bernier; *Politics and Institutions of Government*, under Alan Cairns; and *Economics*, under David C. Smith (co-directed with Kenneth Norrie and John Sargent for the concluding phase of the research program) — were further divided into 19 sections headed by research coordinators.

The area *Law and Constitutional Issues* has been organized into five major sections headed by the research coordinators identified below.

- Law, Society and the Economy — *Ivan Bernier and Andrée Lajoie*
- The International Legal Environment — *John J. Quinn*
- The Canadian Economic Union — *Mark Krasnick*

- Harmonization of Laws in Canada — *Ronald C.C. Cuming*
- Institutional and Constitutional Arrangements — *Clare F. Beckton and A. Wayne MacKay*

Since law in its numerous manifestations is the most fundamental means of implementing state policy, it was necessary to investigate how and when law could be mobilized most effectively to address the problems raised by the Commission's mandate. Adopting a broad perspective, researchers examined Canada's legal system from the standpoint of how law evolves as a result of social, economic and political changes and how, in turn, law brings about changes in our social, economic and political conduct.

Within *Politics and Institutions of Government*, research has been organized into seven major sections.

- Canada and the International Political Economy — *Denis Stairs and Gilbert Winham*
- State and Society in the Modern Era — *Keith Banting*
- Constitutionalism, Citizenship and Society — *Alan Cairns and Cynthia Williams*
- The Politics of Canadian Federalism — *Richard Simeon*
- Representative Institutions — *Peter Aucoin*
- The Politics of Economic Policy — *G. Bruce Doern*
- Industrial Policy — *André Blais*

This area examines a number of developments which have led Canadians to question their ability to govern themselves wisely and effectively. Many of these developments are not unique to Canada and a number of comparative studies canvass and assess how others have coped with similar problems. Within the context of the Canadian heritage of parliamentary government, federalism, a mixed economy, and a bilingual and multicultural society, the research also explores ways of rearranging the relationships of power and influence among institutions to restore and enhance the fundamental democratic principles of representativeness, responsiveness and accountability.

Economics research was organized into seven major sections.

- Macroeconomics — *John Sargent*
- Federalism and the Economic Union — *Kenneth Norrie*
- Industrial Structure — *Donald G. McFetridge*
- International Trade — *John Whalley*
- Income Distribution and Economic Security — *François Vaillancourt*
- Labour Markets and Labour Relations — *Craig Riddell*
- Economic Ideas and Social Issues — *David Laidler*

Economics research examines the allocation of Canada's human and other resources, the ways in which institutions and policies affect this

allocation, and the distribution of the gains from their use. It also considers the nature of economic development, the forces that shape our regional and industrial structure, and our economic interdependence with other countries. The thrust of the research in economics is to increase our comprehension of what determines our economic potential and how instruments of economic policy may move us closer to our future goals.

One section from each of the three research areas — The Canadian Economic Union, The Politics of Canadian Federalism, and Federalism and the Economic Union — have been blended into one unified research effort. Consequently, the volumes on Federalism and the Economic Union as well as the volume on The North are the results of an interdisciplinary research effort.

We owe a special debt to the research coordinators. Not only did they organize, assemble and analyze the many research studies and combine their major findings in overviews, but they also made substantial contributions to the Final Report. We wish to thank them for their performance, often under heavy pressure.

Unfortunately, space does not permit us to thank all members of the Commission staff individually. However, we are particularly grateful to the Chairman, The Hon. Donald S. Macdonald; the Commission's Executive Director, J. Gerald Godsoe; and the Director of Policy, Alan Nymark, all of whom were closely involved with the Research Program and played key roles in the contribution of Research to the Final Report. We wish to express our appreciation to the Commission's Administrative Advisor, Harry Stewart, for his guidance and advice, and to the Director of Publishing, Ed Matheson, who managed the research publication process. A special thanks to Jamie Benidickson, Policy Coordinator and Special Assistant to the Chairman, who played a valuable liaison role between Research and the Chairman and Commissioners. We are also grateful to our office administrator, Donna Stebbing, and to our secretarial staff, Monique Carpentier, Barbara Cowtan, Tina DeLuca, Françoise Guilbault and Marilyn Sheldon.

Finally, a well deserved thank you to our closest assistants: Jacques J.M. Shore, *Law and Constitutional Issues*; Cynthia Williams and her successor Karen Jackson, *Politics and Institutions of Government*; and I. Lilla Connidis, *Economics*. We appreciate not only their individual contribution to each research area, but also their cooperative contribution to the research program and the Commission.

IVAN BERNIER
ALAN CAIRNS
DAVID C. SMITH

Preface

Volumes 15 to 18 of the collected research studies represent the product of the Commission's research program in labour markets and labour relations. The primary objective of these 22 papers is to assess the state of knowledge relating to key aspects of labour market and labour relations behaviour and examine the policy implications of this knowledge.

A wide range of topics was addressed in the labour research program, a reflection of the Commission's extraordinarily broad mandate and the importance of labour-related developments to economic and social performance. In addition, the program was influenced by an advisory group from the disciplines of economics, industrial relations and labour law. Given the broad scope of labour issues and the cross-disciplinary approach taken, the division of the research papers into four separate volumes is as unfortunate as it is inevitable. Although the division chosen is a fairly natural one, some issues receive only brief attention here because they are covered more thoroughly elsewhere.

This volume deals with labour market adjustment to change, including the impact of economic and technological change on the labour market, the role of education and training in a world of changing occupational and skill requirements, and regional labour market mobility. A number of public policies relating to labour market adjustment are examined.

Most closely related to the papers in this book are those in *Work and Pay: The Canadian Labour Market*, volume 17 of the research studies, which deals with key aspects of labour market behaviour and performance, in particular employment and unemployment, labour force participation (particularly that of women), the amount of time spent working by those in the labour force, and equal pay and equal opportunity in

the labour market. Also highly relevant are the two volumes on industrial relations. *Labour-Management Cooperation in Canada*, volume 15 of the research studies, examines the potential role of innovative and non-adversarial approaches to labour-management relations in Canada. Two general considerations connect these potential approaches to the issues examined in this volume: first, cooperation and consultation between labour and management may facilitate adjustment to technological and economic change; and second, organizational change and technological change are often interrelated. *Canadian Labour Relations*, volume 16 of the research studies, examines aspects of collective bargaining and other mechanisms for determining wages and working conditions and assesses the performance of Canada's industrial relations system on dimensions such as occupational health and safety and collective bargaining disputes.

The adaptability of Canada's economy and its institutions, in the face of pressures for change, was a central theme of the Commission's overall research program. Thus there are numerous papers and monographs which bear on the issues discussed here and which the reader of this volume will find useful. Particularly important are Jean-Michel Cousineau, "Unemployment Insurance and Labour Market Adjustments," in *Income Distribution and Economic Security in Canada*, volume 1 of the research studies; D.G. McFetridge, research coordinator, *Canadian Industry in Transition*, volume 2 of the research studies, and *Technological Change in Canadian Industry*, volume 3 of the research studies; D.G. McFetridge, "The Economics of Industrial Policy: An Overview," in *Canadian Industrial Policy in Action*, volume 4 of the research studies; M.J. Trebilcock, *The Political Economy of Economic Adjustment*, volume 8 of the research studies; J.D. Richardson, "Factor Market Adjustment Policies in Response to External Shocks," and M. Robertson and A. Grey, "Trade-Related Worker Adjustment Policies: The Canadian Experience," in *Domestic Policies and the International Economic Environment*, volume 12 of the research studies; R.G. Harris, *Trade, Industrial Policy and International Competition*, volume 13 of the research studies; R.L. Mansell and L. Copithorne, "Canadian Regional Economic Disparities: A Survey," and J. Vanderkamp, "The Efficiency of the Interregional Adjustment Process," in *Disparities and Interregional Adjustment*, volume 64 of the research studies.

W. CRAIG RIDDELL

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Many people contributed to the Commission's research program in labour markets and labour relations and their assistance is gratefully acknowledged. The members of the labour research advisory group — Jean-Michel Cousineau (Université de Montréal), David Dodge (Department of Finance), James Frank (Conference Board of Canada), Morley Gunderson (University of Toronto), Robert Jenness (Economic Council of Canada), Stephan Kaliski (Queen's University), Thomas Kochan (Massachusetts Institute of Technology), Pradeep Kumar (Queen's University), Robert Lacroix (Université de Montréal), Glenn MacDonald (University of Western Ontario), Keith Newton (Economic Council of Canada), Ray Protti (Labour Canada), Frank Reid (University of Toronto), John Vanderkamp (University of Guelph) and Paul Weiler (Harvard University) — provided valuable advice on the research program and commented usefully on various drafts of the papers.

I also wish to acknowledge the assistance received from members of the Commission's research staff, especially Dr. Lilla Connidis, Barbara Cowtan, Caroline Digby, Rod Hill, Joyce Martin and Donna Stebbing. David C. Smith, Director of Research (Economics), provided valuable advice and encouragement, as did fellow research coordinators, especially John Sargent, Ken Norrie and Don McFetridge. Beth Ediger and Rosemary Shipton skilfully edited the papers.

I particularly want to thank my wife Rosemarie and son Chris for their support and patience.

W.C.R.

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Adapting to Change: Labour Market Adjustment in Canada
An Overview

W. CRAIG RIDDELL

Labour market adjustment issues are among the most difficult challenges a society must face. Change creates new opportunities but destroys old ones; it is, in the words of Schumpeter (1942), a process of "creative destruction." Because of change, employment and income opportunities for some individuals will be reduced, perhaps substantially, while prospects for others will be enhanced. Adjustment to change can be painful for those adversely affected. For these reasons, policy discussions relating to economic adjustment are often controversial. At present they are also highly topical. A number of factors — the prospect of rapid technological change in production methods, an increasingly competitive world economic environment, the growth in production in newly industrialized countries, the experience of major economic shocks in the past two decades, and concern that the rise in unemployment, especially the massive increase in the early 1980s, reflects structural as well as cyclical factors — have combined to focus considerable attention on adjustment issues.

Each of the papers in this volume deals with aspects of labour market adjustment. The authors examine different explanations for observed behaviour, discuss the implications of the existing state of knowledge, and assess alternatives for public policy. Morley Gunderson's (1985) paper examines the difficult issues relating to, and current institutional arrangements regarding, permanent layoffs, dismissals and plant closings. The alternative mechanisms for dealing with these phenomena — collective bargaining, competitive market forces, and government regulation — are described and the role each can play is assessed.

Technological change is one important source of labour market adjustment, and in recent years the potential impact of innovations such as

computers, information and data-handling systems, robotics, and telecommunications has attracted considerable attention and debate. Robert Allen's paper provides an historical perspective on the impact of technical change on employment, wages and the distribution of skills. The long-term perspective is particularly appropriate because, as Allen (1985) states, "Ours is not the first age in which technical change has remade society and today is not the first era in which people have feared that technological developments will cause widespread social distress." Kaliski's (1985) paper in the companion volume, Riddell (1985a), also discusses these fears and assesses their basis.

Because of their evident importance to labour market adjustment, issues relating to education and training receive considerable attention in this book. The prospect of rapid technological change has led some observers to speculate that a serious mismatch between the skills demanded by employers and those available in the labour force may emerge. The papers by Steven Globerman and James Davies examine different aspects of this "occupational structural imbalances" view and discuss a variety of policy issues relating to education and training. Globerman (1985) assesses claims that substantial changes in the amount and nature of education are, or will become, appropriate in order to meet emerging skill requirements. Hypotheses relating to the impact of technological change on the distribution of skills demanded by employers are examined by both Allen (1985) and Globerman (1985). Davies (1985) discusses the adequacy and adaptability of our educational and training institutions, the role of governments in financing and directing these institutions, the appropriate balance between education and training (and between the latter's components — institutional and on-the-job training), and assesses various policy options, such as paid educational or training leave, that have been proposed.

As noted in the Introduction, the general issue addressed by the Royal Commission's research program was how Canada's political economy can better adapt to change. For this reason, the theme of this volume — adapting to change — frequently arises elsewhere in the Commission's published research; in particular, in the areas of industrial structure, international trade, income distribution and economic security, macroeconomics, and federalism and the economic union. Although these contributions cannot be discussed in detail in this overview paper, their implications for labour issues will be noted as they arise.

An "adaptive political economy," to use the research directors' phrase, is desired not for its own sake but because it contributes in an important way to the well-being of individuals in society. Pressures for adjustment typically involve society's land, labour, capital and other resources moving from less to more highly valued uses. Adjustment generally raises the total value of goods and services produced, and thus the overall standard of living in society. However, because adjustment

has costs as well as benefits, rapid accommodation of change is not necessarily always desirable. A balance of these benefits and costs is necessary for socially optimal adjustment.

The nature of optimal adjustment is one salient issue discussed in this volume. Possibly of greater concern, however, are the distributional consequences of change. Economic and technological changes create winners and losers. Even though society as a whole benefits from adjusting to change, some individuals will be harmed. Much of adjustment policy focusses on which individuals should be compensated, the design of such assistance programs, and the magnitude of the compensation.

The organization of this overview paper is as follows. The first section briefly outlines the basic issues that arise in labour market adjustment. This section thus sets the stage for much of what follows, both in later sections of this overview paper and in the background papers in this volume. Next, some empirical evidence relating to labour market adjustment is reviewed. Special attention is devoted to the hypothesis that the rise in unemployment in the past two decades is associated with more rapid structural adjustment. The following section examines the way the private market economy and institutional arrangements — personnel policies, collective bargaining and the courts — respond to changing economic circumstances. This provides important background for the analysis of government-sponsored adjustment assistance policies. Subsequent sections discuss the impact of technological change on the labour market and the role of education and training in adapting to change.

Labour Market Adjustment: Some Basic Issues

Adjustment refers to the process by which the economy responds to changes in its environment. Two general types of changes may be distinguished: economic change and technological change. Technological innovations enable society to produce more goods and services with its limited resources. In the Pareto sense society is unambiguously made better off by technical change.[1] Economic change, in contrast, may increase or decrease social welfare. For example, a favourable (unfavourable) change in the terms of trade — the price of imported goods relative to exported goods — raises (lowers) the overall standard of living. It is important to note, however, that adjusting to technological or economic change results in an increase in social welfare relative to not adjusting. In the initial equilibrium situation (before the change), society's resources are allocated to their most highly valued uses. Technological or economic change disturbs that initial equilibrium, creating a situation in which labour, capital, and other resources are no longer allocated to their best uses. Although in this disequilibrium situation social welfare may be higher or lower than before, adjusting to

the new equilibrium will raise living standards as resources move to uses in which their services receive their greatest return. In this sense adjusting to change is always welfare-improving.

However, adjustment has costs as well as benefits. In the labour market, adjusting to change often involves a period of unemployment during which individuals search and/or wait for the best available job. Relocation and/or retraining may also be involved. These are costly both to the individual in the form of lost income, direct expenditures and psychic costs, and to society. Similarly, there are costs — to the owners of the resources and to society — associated with transferring capital, land and other resources from one use to another.

If there were no adjustment costs, society's best option would be to respond instantaneously to economic disturbances and technological innovations. In this way, resources would always be allocated to their most highly valued uses. There would also be strong economic incentives which would produce this outcome. Because of relevant costs, however, instantaneous adjustment is not necessarily ideal. The optimal adjustment path depends on both the benefits and costs of adapting and how these variables are related to the speed of adjustment.

Adjustment makes sense only when the total benefits to society exceed the total costs. When this is the case, the optimal adjustment path maximizes the net benefits to society — that is, the difference between the present values of the future benefits and costs.[2] The present value of benefits depends in an important way on whether the change is temporary or permanent. For a given difference in the value of resources in their current use compared to their best use, the more permanent the change the larger the present value of benefits. For changes that are clearly temporary in nature, society's best option will generally be not to adjust, depending on the magnitude of adjustment costs. When changes are permanent, it is most beneficial to move resources quickly to their more highly valued uses. However, the optimal adjustment path depends also on how costs vary with the speed of adjustment. If there are rising marginal adjustment costs — that is, costs which increase with the speed of adjustment — spreading out the adjustment over several periods will generally be optimal. Nonetheless, under quite general conditions, the optimal response to a permanent change is fairly rapid adaptation, even in the presence of rising marginal adjustment costs (Harris, Lewis, and Purvis, 1984).

The role of changes in relative wages and prices in the adjustment process should also be noted. Such changes provide the signal for resources to move to more highly valued uses. Rigidities in the wage and price structure will tend to slow down adjustment and to result in more of the adjustment falling on employment and output. Vanderkamp (1985) provides a detailed analysis of this point in the context of regional labour market adjustment.

Imperfect information plays an important role in responding to change. Two salient aspects of this role are worth noting. First, the extent to which changes are temporary or permanent, and therefore the benefits of adapting to the disturbance, will typically be unclear. Second, when a change occurs, the now most highly valued use of resources will not often be immediately apparent. For both these reasons, society and its members must make choices in an uncertain environment. This uncertainty will typically spread out or diffuse the adjustment process. Those who believe changes are permanent and those who are able to identify alternative employments quickly and at low cost will adjust rapidly, and vice versa.

The existence of imperfect information implies that some individuals will make mistakes. Some will respond to disturbances that turn out to be temporary and, in retrospect, were not worth adjusting to; others will not adapt when they should have. The fact that some mistakes are inevitable should not lead to despair about adjustment policy. However, we should be cautious in evaluating past performance. What was clearly an error ex post may not have been so evident ex ante. As stated by Kaliski (1985), even "what we think we can predict with confidence is often wrong. A short time ago, nothing seemed more certain, in part because of Japanese technological superiority, than the demise of the North American automobile industry. That industry is now (Summer, 1984) showing considerable vigour and not only because of increased protection." Numerous other examples could be given. As Harris, Lewis, and Purvis (1984) note, the 1973 OPEC oil price shock was expected by most analysts to be temporary yet it turned out to be fairly permanent, while the 1979 oil price shock was expected to be permanent but turned out to be temporary.

A final important distinction is between anticipated and unanticipated disturbances. Firms, workers and consumers will have taken into account shocks which were anticipated, thus lessening the need for adjustment. In addition, as Gunderson (1985) discusses in more detail, market forces — usually through compensating wage differentials — will produce compensation for disturbances that are fully anticipated. Thus, policies to compensate individuals adversely affected by economic or technological change may represent double payment. Here again, imperfect information plays an important role. Many disturbances are only partly anticipated. In this case, compensating wages will reflect the probability of the disturbance occurring; that is, if the shock does in fact occur, it will have been partially compensated for in advance.

The purpose of this brief section was to summarize the most basic issues that arise in the discussion of economic adjustment. We now turn to an examination of some of the empirical evidence on adjustment and subsequently to a discussion of adjustment policy.

Structural Adjustment and Unemployment

In the postwar period there has been substantial growth and structural change in the Canadian labour market. The main trends and changes include the rapid growth of the labour force and employment; the increase in unemployment rates in the 1970s and 1980s; the dramatic rise in female participation rates and in the importance of multi-earner families; the altered age, sex and educational composition of the labour force; the decline in the growth of productivity, and the concomitant decline in real earnings growth, in the past decade; substantial changes in the occupational, regional and industrial composition of employment; the increased importance of part-time work; and the decline in time spent working for full-time workers. These developments are described — and their causes and consequences discussed — in the companion volume, Riddell (1985a).

Many of these changes are dramatic. The labour force of today is, in Kaliski's (1985) words, "unrecognizably different from that of 20 years ago" and even more different from that at the end of World War II. Clearly, the labour market is capable of making substantial adjustments to changes in the economic environment. However, in the past decade concern has frequently been expressed about the adaptability and flexibility of the economy in general and the labour market in particular. Underlying this concern are several interrelated factors:

- The relatively poor economic performance of the past two decades — rising unemployment rates, high and variable rates of inflation, and low rates of productivity and real income growth — compared to the first two decades of the postwar era.
- The view that the adjustments being required of the economy — owing to disturbances such as the 1973 and 1979 OPEC oil price shocks, dramatic changes in basic commodity prices, technological innovations, and changing patterns of international comparative advantage and trade — have increased substantially.
- The perception held by some observers that the adaptability of the labour force may have declined, so that even if the magnitude of economic disturbances does not increase, the size and duration of the adjustment problems associated with these shocks will rise. The hypothesis of reduced adaptability is linked to a variety of phenomena, including changes in social legislation (e.g., unemployment insurance), the rise in dual career families, reductions in immigration, and changes in social attitudes and expectations.
- The dramatic rise in unemployment in the past fifteen years, and the view that this reflects, to a considerable extent, structural adjustment rather than cyclical factors.
- In addition, slower economic growth tends to exacerbate adjustment problems. In a period of moderate or rapid growth in real output, the

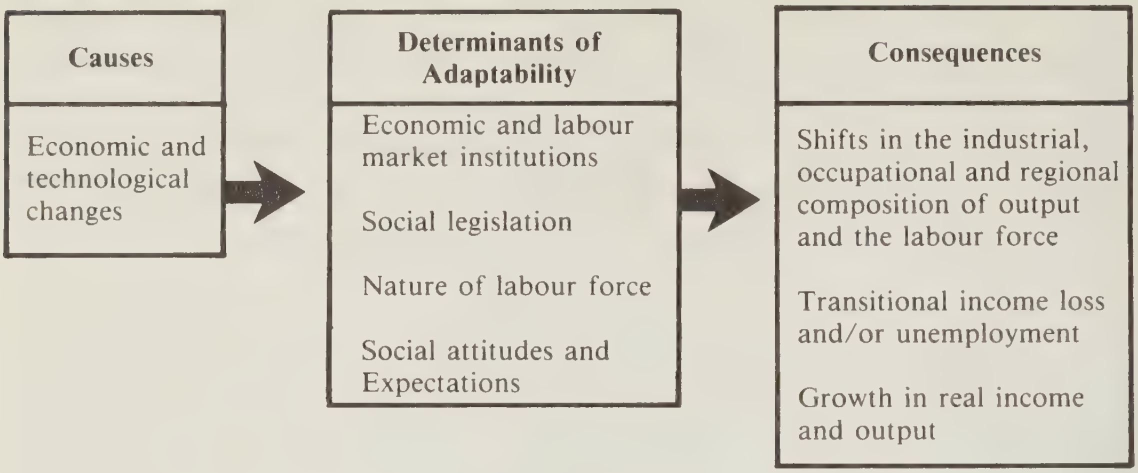
reallocation of resources to their most highly valued uses typically involves rapid growth in some sectors and slow growth in others. This can often be accomplished without any adjustment on the part of the labour force — new entrants into the labour force take jobs in the rapidly growing sectors while in the slow growth sectors those retiring may not be replaced. In a period of slow aggregate growth, economic adjustment typically also involves labour force adjustment — individuals leaving declining sectors and taking employment in expanding sectors.

The relationship among these various factors, hypotheses and perceptions is summarized in Figure 1-1. This diagram illustrates how the sources of labour market adjustment — economic and technological changes — are transformed via the economy's institutional arrangements and other characteristics which determine its ability to adapt to change into the consequences of adjustment. Empirical study of the relationships illustrated in Figure 1-1, and thus testing of the various hypotheses listed above, has not progressed very far. Nonetheless, some evidence is available and is briefly examined here.

Since 1975 the Labour Force Survey has provided data on the flows into unemployment from various sources: job losers, new entrants, re-entrants, and job leavers. These and related data are summarized and discussed in detail in Gunderson's (1985) paper in this volume. Over the 1975–83 period the job losers' category has increased substantially in relative importance. This increase has been quite pervasive — it has occurred in all regions and in each marital status and sex group. Unfortunately, it is very difficult to determine the extent to which this increase reflects cyclical versus structural factors. The time period over which the data are available is short and is dominated by the stagflation of the late 1970s and the major recession of 1982–83. In addition, the job losers' category does not distinguish between temporary and permanent layoffs.[3] Furthermore, the decreased relative importance of new entrants, re-entrants, and job leavers may also largely reflect cyclical factors (e.g., that people are less likely to quit their job to search for a better one in depressed labour market conditions) and demographic trends (e.g., the declining numbers of youth attaining labour force age).

Time series data on the aggregate unemployment rate are, of course, available for a much longer period, and several recent studies have attempted to determine the extent to which the rise in unemployment since the 1960s can be attributed to an increase in the rate of structural adjustment in the economy. In an influential paper, Lilien (1982) found support for the hypothesis that, in the United States, most of the unemployment fluctuations in the 1970s, unlike the 1960s, were associated with structural adjustments. Subsequent studies by Samson (1985), Charette and Kaufman (1984), and Neelin (1985) have investigated this

FIGURE 1-1 Causes and Consequences of Labour Market Adjustment



hypothesis for Canada. The first two studies obtain results similar to those obtained by Lilien (1982) for the United States; Neelin, however, obtains contrary results. Kaliski (1985) and the overview paper in the companion volume, Riddell (1985a), assess these and related studies.[4] At present, the extent to which the rise in unemployment in Canada (and the United States for that matter) since the early 1970s can be attributed to an increased pace of structural adjustment as opposed to alternative explanations remains controversial. The empirical literature has not yet progressed to the point at which there is agreement on the contribution of each of the various factors that appear to play a role. The main competing explanation argues that much of the rise in unemployment reflects both cyclical factors, especially during the period 1982–83, and demographic trends and changes in labour market legislation (especially unemployment insurance and minimum wages). For several reasons it is difficult to determine the separate contribution of each of these factors. Lilien's (1982) measure of structural adjustment — the variance of employment growth across industries — appears to vary significantly with the business cycle, thus attributing to structural adjustment what in fact may be cyclical fluctuations (Abraham and Katz, 1984; Riddell, 1984; Neelin, 1985). Furthermore, the studies of changes in the non-cyclical or "natural" unemployment rate have not satisfactorily tested the various explanations — demographic trends, structural adjustment, and social legislation — against each other (Kaliski, 1985).

An alternative approach to the relationships illustrated in Figure 1-1 would be to attempt to identify the sources of employment fluctuations. Altonji and Ham (1985) have recently provided some preliminary evidence for Canada on this question. They find that over the 1961–82 period, U.S. and Canadian national shocks accounted for 60 to 65 and 23 to 28 percent, respectively, of the variance in national employment growth, while industry-specific, province-specific, and combined indus-

try- and province-specific shocks accounted for only 6 to 12 percent of the variance of employment growth. This suggests additional caution with respect to the structural adjustment hypothesis, although Altonji and Ham do not attempt to determine if the contribution of industry- and province-specific shocks was higher after the early 1970s.

The rate of adjustment of the Canadian industrial structure over the postwar period is examined by Charette, Henry and Kaufman (1985).[5] Their "change indexes" measure the proportions of output (measured by Gross Domestic Product) and employment which are reallocated across sectors from one period to another. They find no evidence that the change in sectoral employment and output shares has accelerated since the early 1970s relative to earlier decades. These results do not necessarily contradict the view that the structural (as opposed to cyclical) adjustments required of the economy have been larger in the past 15 years. However, they do suggest that if this view is correct, the amount of structural adjustment that has taken place has not increased in response.

Change is a pervasive feature of economic life. A large turnover of enterprises occurs as new firms start up, existing firms vacate some markets and enter new ones, and some enterprises die. The birth and death rates of jobs are also large, so that net increases or decreases in employment mask much larger underlying change. Clearly, adjustment to change is an important factor affecting both the amount and duration of unemployment.[6] However, the assessment of empirical evidence carried out in this section indicates that the hypothesis that the rise in unemployment during the past two decades can be attributed to an increase in the magnitude of structural change in the economy receives only modest support. This suggests that policies to promote a more rapid economic recovery have an important role to play in reducing the current high levels of unemployment. However, nothing in this section suggests that unemployment associated with structural adjustment is not an important problem with serious consequences for the individuals affected, their families, and, when mass layoffs and plant closings are involved, the communities in which they live. Adjustment assistance policies also have an important role to play in attempting to ameliorate these consequences. Before discussing adjustment assistance policies, however, it is important to examine how the private economy and its institutions (including the courts) respond to the phenomena associated with economic dislocation.

Also worth stressing is the tentative nature of our knowledge in this area. Measurement of the rate of structural change, its causes and consequences, and the determinants of its variation over time and across countries has been a neglected area of economic analysis. As a consequence, existing knowledge is sketchy and incomplete and various competing hypotheses continue to exist.

Private Market Responses to Economic Change

Both the anticipation of and occurrence of economic and technological change will affect labour market behaviour. An understanding of these behavioural effects is important for the nature and design of adjustment policies. This section discusses how the various market and institutional mechanisms of the private economy — the labour market and compensating wages, unions and collective bargaining, and government legislation and the courts — respond to economic adjustment. The discussion draws heavily on Gunderson's (1985) paper in this book.

The prospect of changing circumstances will evoke a market response. Those firms whose employment carries an above average risk of layoff will need to pay above average wages, holding constant other benefits and working conditions, in order to attract and retain employees. The magnitude of the compensating wage differential will depend on the severity of the risk — for example, it will be greater for permanent than temporary layoffs — and the extent to which an adverse outcome is anticipated. The latter implies that the quality of information about the risks of economic dislocation is key to the functioning of the market mechanism.

The market response — a compensating wage differential associated with the risk of job dislocation — has three important consequences. First, compensating workers dislocated by economic change will involve "double payment" to the extent that some compensation was received ex ante for the risk of layoff. Thus, if a case for adjustment assistance policies exists (a matter to be discussed subsequently), it is strongest in those instances in which the dislocation was unanticipated. Second, the need to pay compensating wages provides an incentive for employers to economize on layoffs. Firms will compare alternative adjustment strategies — attrition, retaining redundant workers, retraining, early retirement, and so on — and will choose the least costly strategy. The prospect of having to pay compensating wages forces firms to internalize in this calculus the costs to employees of adjusting through layoffs versus other means. Because the costs to both employers and employees are taken into account, the adjustment decision may be socially efficient in the Pareto sense. Third, compensating wage differentials facilitate a socially optimal matching of employees with job characteristics. Those individuals who are highly risk averse to income fluctuations will choose employers with a reputation for providing stable employment and will forego the higher wages available from less reliable employers, and vice versa for those who are less risk averse.

The risks associated with changing circumstances create a demand for insurance from risk-averse individuals. Several responses to this demand will tend to emerge: private insurance markets, risk-sharing

between employers and employees, and self-insurance (wealth diversification, personal saving, taking precautions).

A variety of factors (discussed subsequently) may prevent market forces from yielding a socially efficient outcome. Nonetheless, as stated by Gunderson (1985):

> [E]ven if the market does not work perfectly in this area, it is likely to exert very strong pressures in the directions discussed. . . . The key policy issue then becomes one of how best to harness those pressures to make them work in a socially desirable fashion without thwarting their ability to put pressure on the private parties to deal with severance problems in a humane and cost effective fashion and to make sure that all parties take proper precautions and preparations before, during and after the event.

Unions and collective bargaining can both exacerbate and ameliorate the problems associated with adjustment to change. By favouring layoffs and employment reductions over alternative adjustment mechanisms — such as work sharing and wage reductions or other concessions — unions tend to increase the magnitude of the employment adjustments that result from a particular economic disturbance, thus shifting more of the cost of adjustment to public programs such as unemployment insurance, as well as to the individuals affected. This preference for employment reductions over alternative adjustment strategies is consistent with the view that unions represent primarily the preferences of older, more senior workers, whereas competitive market forces respond chiefly to the preferences of younger, more mobile workers. It is this younger group that firms generally try to attract and retain.[7] The fact that unions also raise wages above competitive market levels may also worsen adjustment problems, as workers laid off from well-paid jobs will remain unemployed longer in the hope that their former job returns.

At the same time, unions can ease adjustment in various ways: by providing a collective choice mechanism for determining the workers' preferences with respect to alternative adjustment mechanisms; by providing a "voice" mechanism for articulating these preferences to the employer;[8] by facilitating the exchange of information between management and workers (through collective bargaining and joint committees); by negotiating notice provisions, severance pay and supplementary unemployment benefits in collective agreements; and by providing "due process" in dismissals through administering the collective agreement and grievance procedure. Although unions may perform these functions in various degrees, the available evidence — such as that with respect to the extent of joint consultation on adjustment issues and the extent of advance notice provisions, severance pay and supplementary unemployment benefits in collective agreements — suggests that these functions have not received high priority in the past (Gunderson, 1985). The

experience of the 1982–83 recession — during which layoffs affected many senior workers — may alter these priorities.

The courts have increasingly been involved in disputes over adjustment to change, mainly in the form of wrongful dismissal cases. The usual grounds are insufficient notice. Gunderson (1985) discusses the current Canadian situation in this area. These cases have mainly involved higher income personnel; the majority of the labour force relies on firms' personnel policies (presumably influenced by compensating wages, as discussed earlier), collective bargaining, and employment standards legislation with respect to advance notice, severance pay and unjust dismissal. These legislative initiatives are discussed in the following section.

Adjustment Policy

Adjustment policy is a large and complex subject. Much of what is called industrial policy or industrial strategy is in effect adjustment policy. It involves issues such as whether "sunrise" and "sunset" industries can be identified and how the economy can best shift — or avoid shifting — out of declining sectors and into expanding sectors. Trade policy also has important implications for economic adjustment. Similarly, much of what is called regional development policy is also adjustment policy — typically taking the form of trying to reverse the economic forces that would otherwise cause movement out of depressed regions and into rapidly growing regions. As a final illustration, much of our income security and social support system is a form of adjustment policy, providing to individuals insurance against the risk of adverse outcomes due to changing circumstances. Clearly, it is neither possible nor desirable to attempt to discuss all these dimensions of adjustment policy here. The emphasis rather will be on labour market aspects of adjustment policy — although no neat separation between these and other aspects can be made. The reader interested in the other dimensions may find the following studies helpful, along with the references therein: on industrial policy, Harris (1985), McFetridge (1985b), Trebilcock (1985a); on regional development and adjustment policy, Norrie (1985), Mansell and Copithorne (1985), and Vanderkamp (1985); on trade policy and adjustment, Harris (1985), Hill (1985), Richardson (1985), and Robertson and Grey (1985); and on income security and social support, Cousineau (1985), Kesselman (1985), and Vaillancourt (1985).

Although economic and technological changes produce winners and losers, adjustment policies typically focus on those adversely affected. A variety of different policies have emerged. Some operate through employment standards legislation and involve provisions such as those relating to advance notice, severance pay and unjust dismissal. Another group of policies attempts to support declining industries or firms threat-

ened with bankruptcy — through subsidies, protection from competition (tariffs, quotas), or bailouts. These policies generally have the effect of slowing down the adjustment process — possibly even preventing it from occurring. Another set of policies provides compensation to those adversely affected by economic changes, and can be viewed as a form of social insurance. Adjustment assistance policies provide this compensation in the form of assistance tied to adaptive behaviour — relocation and retraining grants or subsidies are the main examples.

Adjustment policies thus can impede or encourage adjustment, or provide insurance against the risks associated with change, possibly attempting to be neutral with respect to the speed of adjustment. To determine what form these policies should take, we must first look at the objectives of the policies and then determine which policies are most likely to meet those objectives.

Rationales for Adjustment Policies

There is a variety of possible rationales for adjustment policies. Although these reasons are interrelated, they can be discussed under four headings:

- market failure in the adjustment process;
- market failure in insurance markets;
- equitable assistance to losers; and the
- "political economy" rationale — impediments to adjustment will proliferate if assistance to those adversely affected by change is not provided.

The first two rationales relate to the social efficiency of market outcomes.[9] The potential for market failure — and therefore for increasing social welfare by some form of intervention in market outcomes — is usually discussed in terms of the economy's static equilibrium. However, the social efficiency of the adjustment process — the movement from one equilibrium position to another — is also clearly important. The papers by Davies (1985) and Gunderson (1985) provide a clear statement of the conditions under which market processes will yield socially optimal adjustment: absence of externalities, perfectly competitive markets, and complete insurance markets.[10] Under these conditions the social costs and benefits of adjusting to change are taken into account by private decision makers. The role of compensating wages in internalizing social costs and benefits in the decision calculus of firms and workers was discussed in the previous section. In addition to phenomena associated with the prospect of adverse outcomes, there are private market responses such as severance pay, advance notice, and supplementary unemployment benefits which occur ex post.

Market Failure in the Adjustment Process

Although few would argue that the conditions for socially optimal adjustment hold literally, the relevant questions for public policy (at least from the efficiency perspective, which is our current concern), are (1) whether there are significant sources of market failure which would prevent private decision makers from taking social benefits and costs into account, and (2) if there are such sources of market failure, whether government intervention would improve matters. Several potential sources of market failure have been identified, including congestion externalities associated with mass layoffs, insufficient incentives to innovate in personnel policies including those relating to adjustment, and externalities in the bankruptcy decision (Gunderson, 1985; Harris, Lewis, and Purvis, 1984; Trebilcock, 1985a).[11] The notion of congestion externalities is similar to that involving traffic congestion on highways with limited capacity; those making layoff decisions do not take into account the consequences of their adding to the pool of unemployed or the probability of reemployment of others in the pool, given the limited absorptive capacity of the labour market in the short run. The existence of such externalities could justify on efficiency grounds the different treatment of mass versus other layoffs observed in several Canadian jurisdictions (for example, longer advance notice requirements) or even temporary assistance to firms that would otherwise engage in mass layoffs to facilitate a more gradual downward adjustment. However, it is debatable whether these constitute real as opposed to pecuniary externalities[12] in that there are market mechanisms for internalizing the costs of layoffs which strain the capacity of the labour market — including, ex ante, compensating differentials for the risk of mass layoffs and, ex post, changes in reservation wages of unemployed workers (Gunderson, 1985). This observation is not intended to deny the very serious consequences for individuals and in some cases communities resulting from mass layoffs. The point is that these adverse consequences are largely — perhaps entirely — distributional in nature rather than resulting from market failure.

That there may be, in the absence of the ability to patent or otherwise capture the benefits of innovations, underinvestment in research and development is a widely recognized consequence of the public goods nature of information. Gunderson (1985) notes that this principle also applies to innovations in personnel policies, including those relating to adjustment:

> Thus, it may not be in the interest of an individual firm to invest considerable resources in finding out about lifetime commitment systems in Japan, or job enlargement programs in Sweden, or early retirement policies in Europe, or work-sharing arrangements. However, it may be in their collective interest to do so. Hence, there may be a rationale for public intervention in the

collective provision of such information or in the support of pilot projects on such policies.

While this argument may provide a rationale for government support of research on innovative personnel policies,[13] it does not justify policies to assist displaced workers, bail out failing firms, or other forms of adjustment policy.

Bankruptcy decisions will be socially inefficient if enterprises which are economically viable (perhaps after some reorganization, merger with another firm, wage and benefit concessions by employees, or price concessions by suppliers) are allowed to fail.[14] This outcome could occur if those making the decision — perhaps because of strategic behaviour, transactions costs or the provisions of bankruptcy, anti-trust and other legislation — do not adequately take into account the costs imposed on other interested parties, such as employees (Harris, Lewis, and Purvis, 1984; Trebilcock, 1985b). However, the costs of bankruptcy are large and this probably mitigates against inefficient outcomes. Some changes to bankruptcy and other legislation could be considered in order to ensure that the various parties are not constrained to a subset of the available options (Trebilcock, 1985b). However, the possibility of externalities in the bankruptcy decision does not provide an efficiency rationale for corporate bailouts except in very narrowly defined circumstances. Furthermore, a policy designed to save firms that would otherwise be faced with inappropriate bankruptcy would have a variety of consequences which would tend to offset to some extent any desirable consequences of the policy.[15]

In summary, a variety of potential market failures in the adjustment process have been identified. Although these possibilities are not without some foundation, they do not, individually or as a group, provide a strong efficiency rationale for adjustment assistance policies. On efficiency grounds, adjustment to economic and technological change should therefore be largely left to market forces — with some attention being paid to government support of research on alternative personnel policies, including those relating to adjustment, and to the social wisdom of bankruptcy decisions. (This conclusion is also qualified by the fact that possible market failures in insurance markets have not yet been examined.)

This conclusion does not imply that adjustment will always occur quickly, that mistakes will not be made in the adjustment process, or that economic disturbances will not result in significant hardship for some individuals. On the contrary, adjustment may sometimes occur slowly, either because the costs of rapid adjustment are high or because many individuals perceive the shocks as being largely temporary in nature. Similarly, mistakes will be made and, because of these errors, many individuals will incur substantial losses. What the conclusion does imply

is that government intervention in the adjustment process, with the possible exceptions noted above, is unlikely to make society as a whole better off. Costs of adjustment and imperfect information about future economic developments are real problems that will exist whether or not governments intervene in market processes.

Market Failures in Insurance Markets

In a world of risk and uncertainty there is an important set of markets in addition to those which allocate goods, services, and society's land, labour and capital resources — the markets for allocating risks. These are often characterized by market failure because of adverse selection and moral hazard problems, as discussed by Davies (1985) and Gunderson (1985) in this volume. For these and possibly other reasons, private insurance companies generally do not offer insurance against the full range of risks associated with economic and technological change. The absence of private markets for unemployment insurance is the most prominent example, one that is sometimes cited as an efficiency rationale for publicly provided unemployment insurance.[16]

The absence of complete insurance markets is a particularly difficult problem for workers whose income derives mainly from paid employment. The owners of firms can reduce the risk associated with economic change through portfolio diversification in capital markets. Most workers' wealth, however, derives from the individual's human capital, and the riskiness of that wealth is difficult to reduce through diversification.[17]

However, as noted in the previous section on private market responses to economic change, private insurance arrangements do arise in response to this demand. In addition to self-insurance (through personal saving, family career diversification), employers may provide insurance in the form of implicit or explicit contracts with various degrees of employment security. As discussed earlier, firms will provide these arrangements not out of benevolence but because doing so reduces the compensating wage associated with employment instability, and thus labour costs. In this way employers can transfer the risk from the labour market to the stock market, where it can more readily be diversified. In addition, firms are better able — through their screening practices in hiring and through institutionalized procedures for layoff (e.g., by seniority) — than are private insurance companies to handle the moral hazard and adverse selection problems. Severance pay, supplementary unemployment benefits, and advance notice provisions may also form part of these implicit or explicit contracts, as discussed above. However, these contracts do not provide "full coverage." The firm may become bankrupt if a particularly "bad draw" occurs, and most firms have difficulty providing insurance against cyclical fluctuations in the economy.

The incomplete nature of insurance markets, particularly those for human capital risks, may be argued to provide an efficiency rationale for

publicly provided unemployment insurance, or more generally for social insurance against the risks associated with economic change, whether adverse outcomes involve unemployment or not. However, it does not necessarily follow that a specific public policy will improve social welfare. The fact that these markets do not exist is an indication that, given the transactions costs and moral hazard and adverse selection problems, the value of the insurance to society is less than the costs of providing it would be. Publicly provided insurance schemes will also face similar moral hazard and adverse selection problems, and these raise the costs of the program to society. Policy design and the particulars of the situation will determine whether the benefits to society exceed the costs.[18]

Two additional conclusions emerge from this assessment of market outcomes relating to adjustment, risk and uncertainty. First, to the extent that adjustment policies are justified on social efficiency grounds, the rationale is a general one, rather than directed toward particular sources or types of adjustment such as trade-related policy or deregulation. Second, there appears to be little justification on efficiency grounds for policies which bail out failing enterprises or compensate the owners of firms for losses due to economic change. However, the analysis does provide some support for adjustment assistance to workers because of the difficulties associated with diversifying human capital risks; moreover to the extent that market failures in the adjustment process exist, they involve externalities (congestion, bankruptcy decisions) in which those making the decision do not fully internalize the costs to the affected employees.

Equity Issues

Equity considerations probably loom much larger than those of efficiency in adjustment policy decisions. Economic changes can bring considerable harm to some individuals, and it is generally viewed as just for society to assist those individuals harmed, particularly when the shocks were unanticipated (so that ex ante compensation would not have been received), when they result in significant declines in the individual's wealth, and when hedging against the shocks would have been difficult. The latter two factors suggest that the focus should be mainly on compensating workers, consistent with the conclusions from the efficiency analysis.

Trebilcock (1985a) examines the implications for adjustment policy of both the utilitarian and social contract (Kantian) perspectives on social welfare decision making. This more formal analysis yields a similar conclusion: "market failure arguments in an economic framework and utilitarian and Kantian ethical arguments for compensation converge to a significant extent and yield a sharp focus on the adjustment costs faced by labour than by capital."

Political Economy Rationale

Probably the strongest argument for adjustment assistance policies is that, in their absence, political pressures would result in policies — such as subsidies to declining industries, bailouts of firms threatened with bankruptcy, and protectionist measures such as tariffs and quotas — which inhibit adjustment and harm society as a whole. As stated by Gunderson (1985):

> In circumstances where workers are guaranteed a degree of due-process and compensation they are less likely to resist efficient changes associated with such factors as technological change, deregulation or import competition. This suggests that compensation policies (e.g., mobility and retraining allowances) that are directed toward encouraging the efficient change are more likely to achieve both equity and efficiency objectives. This is in contrast to policies that discourage the change, which by postponing the inevitable, may perhaps exacerbate the magnitude of the ultimate change.

The source of the problem is not difficult to identify. The benefits of adjusting to change are fairly widely distributed; for example, a reduction in the price (or increase in product quality, holding constant the price) of imported products such as automobiles or textiles benefits each consumer of the affected products. However, the costs of adjusting to the change are fairly concentrated; the employees and owners of firms in the import-competing sector may face substantial dislocation and reduction in their wealth. The observation that the benefits to society of adjusting to the change outweigh the costs might be thought to be sufficient for informed governments to allow the adjustment to occur. However, governments respond to political pressures as well as reasoned arguments. Individuals who stand to lose from the change form an effective lobby group in that they are easy to organize (being concentrated in one industry and often only a few locations), are threatened with substantial losses, and thus are willing to devote considerable resources to fighting the change. Those that stand to benefit typically form an ineffective lobby group; they are dispersed and difficult to organize and are not willing to devote considerable time and effort to fighting for the adjustment, given the small gains to each individual. Thus policies which are harmful to society as a whole may well be chosen, a "failure in the political process" analogous to the potential market failures discussed above.

The implications of political pressures for adjustment policies are discussed in detail by Trebilcock (1985a, chap. 1). His conclusion is that the types of policies that will be chosen are in many respects diametrically opposed to those that are recommended by efficiency and ethical considerations:

> Confronted by sectoral industrial decline induced by changes in international terms of trade, politicians face incentives first to adopt tariff, quota or

like policies, where these are not legally constrained; where so constrained, then to adopt policies to subsidize industries at the firm level to maintain industry output and employment by supporting the most marginal firms in the least visible or most symbolically reassuring ways; then to subsidize labour adjustment costs but tightly restricting the scale of direct expenditures in this context so as to contain public concerns over government spending and deficits and to mute negative symbolism associated with acknowledgement of industry decline or death and the inability of government to avert that outcome.

The Canadian experience with corporate bailouts and policies with respect to declining sectors is examined in Trebilcock (1985a, 1985b). This examination supports the concern expressed above that, because of this failure in the political process, policies which make the community as a whole worse off may be rationally chosen and retained. The conclusion is clear: the case for adjustment assistance policies is much stronger than that based on efficiency and equity considerations. To the extent that such policies reduce the resistance to change expressed through the political process, they are likely to yield a large social dividend.

Consequences of Adjustment Assistance Policies

Policies to assist those adversely affected by economic shocks and insure individuals against the risks associated with change will, if properly designed, have their intended effects: to improve the efficiency of the adjustment process and of insurance markets; be equitable; reduce resistance to change, and, therefore, reduce the likelihood that socially inefficient policies will be adopted and/or retained. However, like many labour market policies, positive adjustment policies will have additional consequences which will offset to some extent the intent of the policy and will raise its cost. These additional effects arise for two closely related reasons. First, adjustment assistance policies insure individuals against the risks associated with change. The better the insurance protection, the more willing people become to take risks, and thus the greater the costs of economic disturbances to society. Second, the private market responses to the prospect and occurrence of economic adjustment will be reduced, shifting more of the burden to the publicly funded programs which are a "free good" to employers and employees. Thus, compensating wages for the risk of layoff will be reduced, employers will rely more on layoffs and less on other forms of adjustment, and firms and workers will engage less in concession bargaining. These and other consequences of adjustment assistance policies are discussed in Gunderson's (1985) paper in this volume and, largely in the context of unemployment insurance, in the overview paper in Riddell (1985a).

Policies which operate through labour standards legislation —

advance notice, severance pay, and unjust dismissal provisions — also have adverse consequences. By raising the cost of dismissal, these policies provide greater protection to current employees but at the expense of new entrants and others seeking work, because employers will become more cautious in their hiring behaviour. Archibald and Chinloy (1985), in particular, have emphasized the social benefits of an "easy fire, easy hire" policy.

None of this should be taken to imply that adjustment assistance policies and provisions relating to severance pay, advance notice, and unjust dismissal are unwise. However, the observation that such policies can be expected to have — and in empirical studies have been found to have — adverse, often subtle consequences which partially offset and raise the social cost of the policies should be taken seriously in their design.

Technological Change

There is intense interest at present in the subject of technological change and its labour market implications. Some believe that we are on the verge of, or in the early phases of, a wave of technological change that is unparalleled in history. Innovations in areas such as computers, telecommunications, microelectronics, robotics, and bio-technology are predicted to have profound effects on society, including effects on the nature of work, the location and organization of production, the skills demanded by employers, and the living standards of the population. Concern about technological unemployment, an issue which has been largely dormant since the automation debate of the 1950s and early 1960s, has risen.

Others are skeptical of these predictions. They point out that technical change has always been going on and that society and the labour market have adapted well to significant innovations — such as the automobile, plastics, electronics, television, and computers — in this century as in others. They also assert that fears about technological unemployment have proven unfounded in the past.

The subject of technological change is complex as well as controversial. The discussion here is necessarily brief and limited to the labour market consequences — employment, wages and skills. Robert Allen's (1985) paper in this volume provides a detailed analysis of these issues. Kaliski (1985) also discusses technological change in his survey of the Canadian labour market.[19]

Earlier in this paper a distinction was made between technological and economic change. Technological change enables a greater output (or higher quality) of goods and services to be achieved with given quantities of inputs into production. Thus, technical changes make society better off; with its limited resources, the economy can produce a greater quantity (or quality) of goods and services, raising average living stan-

dards. Economic changes, in contrast, may raise or lower average living standards. This distinction becomes somewhat blurred when the technical change also causes an economic change — such as a deterioration in the terms of trade. This can occur with biased technical change, a possibility discussed in detail by Allen (1985). Biased technical change lowers the costs of producing a particular product more in some countries — because the new technologies are more suited to the physical environment or price structure in these countries — than in others. Although the biased technical change raises average living standards in the world, this outcome need not occur in each country or region.

There is widespread agreement that technical change has been a major source of rising living standards over the past century or more. Allen (1985) discusses the techniques that have been used to estimate the contribution of technical change (as well as other factors such as increased inputs — for example, more capital per worker, and the improved health and education of the labour force) to economic growth. These studies conclude that the bulk of the increase in real per capita income can be attributed to technical change.

Given this consensus about the enormous benefits of technical change to society, why is there fear and concern? Labour market concerns appear to focus on three main issues: the possibility of a substantial increase in technological unemployment; the prospect of there being significant numbers of losers as well as gainers from innovations in production, and the effect of technical change on the distribution of skills and income in society. The first two issues are discussed in this section, and the third in the following section.

The mainstream view among economists is that technological change may result in temporary increases in unemployment but that permanently higher levels of unemployment are unlikely. There are both theoretical and empirical reasons for this position, which some might describe as optimistic. Allen (1985) outlines the effects of technical change on an individual labour market (partial equilibrium) and on the economy as a whole (general equilibrium). In the partial equilibrium setting, technical innovations may either increase or decrease labour demand. Historically, most innovations have been labour saving, making reductions in labour demand more likely. Reductions in labour demand imply that either wages or employment (or both) will decline. It is this prospect that underlies concerns about technological unemployment. However, reductions in labour demand in individual labour markets, when these occur, are offset by increases in labour demand elsewhere — the general equilibrium consequences. These consequences are explained by Allen (1985):

> [T]he total effects of a technical change are not confined to the industry in which it occurs. Raising efficiency in the production of one commodity will lower its price. Two consequences follow. First, the real incomes of all

> consumers increase. This is the process by which the benefits of technical change (i.e., rising real incomes) are distributed over the community. Second, because the real incomes of consumers rise, the demand for most goods in the economy rises. As a result, the demand for labour in most industries increases. These increases in labour demand provide job opportunities for the workers initially displaced by the technological change.

The general equilibrium effects are less obvious, especially to those who have not had the opportunity to study economics, than the labour-displacing consequences which may occur in an individual labour market.[20] This fact may partly explain the recurring phenomenon of general fears of technological unemployment.[21]

Historical evidence supports the prediction that innovations which increase production efficiency will not result in higher levels of unemployment. Technical changes have been occurring for many years and, although unemployment rates have fluctuated, they have not displayed an upward trend. The substantial increases in unemployment that have occurred, such as in the 1930s and early 1980s, are widely recognized to have been caused by a decline in the total demand for goods and services relative to the economy's ability to produce. There is no evidence that these significant increases in unemployment were caused by technological change. If labour-displacing technical changes have ever resulted in increases in the overall unemployment rate — an outcome which could occur, at least temporarily, if the pace of technical progress is high relative to the economy's ability to adapt to change — these effects must have been sufficiently small and/or temporary to have eluded those carrying out empirical research on unemployment.

Using input/output analysis, Magun (1984) has separated the change in employment observed in Canada between 1971 and 1979 into two components: those due to changes in final demand, and those due to changes in the inputs used to produce a given level of output. For the total commercial sector, the change in final demand resulted in an employment increase of 2.3 million jobs, while the change in input requirements resulted in a decrease of 630,000 jobs. The extent to which changes in each component are due to technological versus other sources of growth and change is not known. However, these results clearly demonstrate the importance of taking into account the general equilibrium effects of technical change.

As Allen notes, there has been some controversy — mostly among the early classical economists — regarding the effect of technical change on real wages. This is perhaps surprising given the consensus that technical progress — with the possible exception of biased technical changes which may cause a deterioration of the economy's terms of trade — raises real per capita income. Wages and salaries make up the bulk (77 percent in 1982) of national income. An increase in real per capita income but not in real wages would require either a massive shift

toward profits in the functional distribution of income or a highly elastic labour supply to the economy as a whole. Neither appear likely.[22] The evidence, as Allen (1985) discusses in more detail, supports this prediction. Historically, technical progress has been associated with rising real wages.[23]

The empirical finding that technical progress is associated with rising real wages supports the expectation that the general equilibrium effects, which increase labour demand in many industries, are likely to outweigh any reductions in labour demand in particular labour markets. If this were not generally the case, a reduction in real wages would be needed to restore aggregate labour market equilibrium following an improvement in productive efficiency.

Although both economic theory and empirical evidence indicate that technical progress has favourable effects on key aggregate economic variables (real per capita income, real wages, employment), they also indicate that some individuals may be adversely affected. Technological changes increase the demand for some skills and occupations and reduce, perhaps eliminate, the demand for others. Some workers' real wages and living standards may fall as they are displaced to their next best employment alternative. In some cases, especially for older workers, the available alternatives may be sufficiently poor to encourage these workers to withdraw from the labour force. Allen (1985) gives several examples of technical changes, such as those in cotton weaving and shipbuilding, which had very substantial adverse effects on particular groups of workers. Policy issues relating to technological change are thus the same as those discussed earlier. From the point of view of overall living standards (economic efficiency), the preferred option is to leave changes in production techniques to be determined by market forces. However, this strategy will produce losers as well as winners and, on equity and political economy grounds, there is some justification for policies to compensate losers or to help them adjust to changing circumstances. Such adjustment may involve training (or retraining) and is examined subsequently.

Before leaving this section, three additional observations should be made:

- Although in a closed economy, society might prefer to slow down the rate of introduction of new technology (and therefore slow down the rate of growth in real incomes) in an attempt to reduce the adjustment costs on displaced workers, this choice is not available in an open economy.[24] Not introducing more efficient production techniques will simply result in losing markets to foreign competitors, and may therefore increase adjustment problems.
- Technical change and organizational change are closely related in many circumstances. Policies to facilitate the process of organiza-

tional change, such as joint labour-management cooperation, may also permit smoother adjustment to technological innovations. Prior consultation between employers and employees on the introduction of new technology into the workplace appears particularly promising. These issues are discussed in more detail in Riddell (1985c).
- Despite the conviction with which many predictions are accompanied, there is considerable uncertainty about what changes in production processes will occur, when these will take place, and what their consequences for particular countries, regions, skills and occupations will be. Kaliski (1985) emphasizes this uncertainty and concludes that: "If I am correct that the details of the forthcoming technological changes are (and perhaps can be) only dimly perceived, then the only preparation that we can now undertake is to strive for flexibility in our institutions and attitudes." As noted earlier, adjustment assistance policies may contribute to this objective by reducing resistance to technological and economic change.

Education and Training

Technological and economic change decrease the demand for some skills and occupations and increase the demand for others. The belief that we are in, or about to be in, a period of unusually rapid change has led to concerns about occupational and skill imbalances and has focussed considerable attention on education and training. Questions such as the following are being widely discussed and debated:

- Should we as a society devote more resources to education and training?
- Are changes in the nature of school curricula needed?
- Has much of the labour force become, or is it about to become, deskilled?
- What role can educational and training institutions play in facilitating adjustment to change?

This section discusses these and related issues, drawing on the papers by Allen (1985), Davies (1985) and Globerman (1985) in this book.

It should be emphasized at the outset that the focus of this section — the relationship between education and training and labour force adjustment — is deliberately narrow. Broader social issues such as the contribution of education to enable individuals to reach their full potential, equality of educational opportunity, and the role of universities as repositories of knowledge and as social critics are not examined here or in the background papers in this book but are clearly of fundamental significance.

During the 1970s concern was expressed on several occasions that serious labour market imbalances — shortages in some, usually highly

skilled, trades and occupations and surpluses in others — were becoming characteristic of the Canadian labour market. The studies which examined these concerns are reviewed in Davies's (1985) paper in this book. (See also the detailed review by Smith, 1983.) With the very substantial rise in unemployment in the 1980s the policy focus has shifted from the issue of structural imbalances to that of the imbalance between aggregate labour demand and supply, and the related questions of whether and how to promote a more rapid economic recovery. Nonetheless, fears that structural imbalances may appear as the economy returns to more normal levels of employment are frequently expressed.

Whether or not there were serious labour market imbalances in the 1970s that could have been lessened or even prevented by judicious public policies remains an open question. This does not imply that no surpluses and shortages were identified ex post. The importance of lagged supply responses in the labour market, particularly for highly trained occupations and trades (e.g., four to five years to train an engineer), and the dynamic nature of our economy combine to make some mismatches almost inevitable. Clearly if, say, a shortage of electrical engineers occurred in 1979, a policy which had in 1974–75 encouraged individuals to enter programs in electrical engineering would have been wise. But this is equivalent to telling an investor that it would have been a good idea to have purchased the stock which tripled in value last year. The relevant question is whether more judicious policy choices could have been made given the information that was available at the time. The answer to this query is difficult to determine, which is why the structural imbalances question remains open.

Two broad policy approaches to these issues of structural and technological unemployment can be identified. One, which might be called the labour market planning approach, involves expending more resources on forecasting future labour market needs and skill requirements and using these forecasts to set education and training levels for various trades and occupations. The development of the Canadian Occupational Projection System (COPS), described in Rochon (1983), is an example of this approach. The second approach stresses the considerable uncertainty which must be attached to any such forecasts and is skeptical of the ability of decisions made on the basis of these forecasts to be better on average than those made currently by the thousands of individuals making career choices in schools, colleges and universities. This approach stresses adaptability to changing labour force requirements, and would devote resources to enhancing institutional flexibility.

Related to these two approaches are differing views about the nature of formal education most appropriate in a rapidly changing society. These positions are outlined in more detail in Globerman's (1985) paper. The "generalists" stress learning the ability to learn, to think and to communicate rather than specific skills. Although there is not a con-

sensus on the precise recommended curriculum, most would include basic reading, writing, communications and computational skills. Implicit or explicit in the generalists' position is the view that the skill content of many jobs may change unexpectedly and the ability of individuals to adapt to these changes will be enhanced by a foundation in these basic skills. Associated with the labour market planning approach is the "technicians" position that emphasizes training for specific occupations and skills, and would typically advocate giving higher priority to science and computing programs in schools and to vocational over general schooling.[25] Implicit or explicit in this approach is the view that future skill requirements can be forecast with some reliability and that formal retraining programs can be instituted in response to changing labour force needs.

Empirical Evidence on Education and Labour Force Adaptability

Globerman (1985) assesses three related bodies of evidence which shed light on these alternative positions and, more generally, on the relationship between formal education and technological unemployment. The studies cover the postwar period, and particular attention is paid to the impact of recent technological innovations such as robotics, computer-assisted design and manufacturing, and office communication systems. Much of the evidence comes from case studies, and the conclusions are qualitative rather than quantitative. The first set of studies provide evidence on the impact of technological change on occupational skill requirements. Davies (1985) also examines related evidence and assesses future trends. The central conclusion is that technical changes increase skill requirements in some cases and decrease them in others; on average there is no evidence that technical progress results in an increase or decrease in occupational skill levels. The second set of studies examines the link between required skill changes and formal education. These studies indicate that, in general, technical change has not been found to result in the need for a more highly educated work force or, indeed, for more technically trained workers.

These conclusions suggest that the prospect of rapid technological change is not an argument for devoting increased resources to education and training. As stated by Globerman (1985):

> [U]nless future experience differs markedly from the past, the forecasts of some technological gurus for a massive "upgrading" in required skills in the work force, or even for a sharp divergence from existing broad patterns of skill demand, are likely to prove highly exaggerated. While the evidence on the skill-related impacts of the "microprocessor revolution" is still fairly limited, it does not suggest that recent experience is fundamentally different from experience over the preceding postwar period. That is, there are

> apparently non-neutral impacts on occupational skills, but the skill adjustments required to avoid widespread displacement of existing workers and managers are relatively modest. While one can only speculate about the future, there is no compelling reason to believe that the future pattern of the technology-skill relationship will differ markedly from the pattern up to now.

Davies's (1985) conclusion is similar: "the argument that the overall scale of support for education and training is rapidly increasing due to technological change appears weak."

These conclusions do not necessarily imply that too many (or for that matter too few) of our scarce resources are devoted to formal education. As both Davies (1985) and Globerman (1985) emphasize, it is difficult to determine, with the available knowledge, whether existing levels of expenditure on education are socially optimal. What the conclusions do imply is that there is little support for the argument that existing levels of expenditure on education should be increased because of the prospect of rapid technical change.

Globerman (1985) also assesses evidence relating to the relationship between formal education and the response to changing patterns of demand in the labour market. To what extent does formal education enable workers or managers to adapt more readily? The key finding here is that most cognitive job skills are acquired on the job, either in formal training programs or informally. Formal education appears to facilitate on-the-job adjustment to technical changes. That is, retraining is more likely to be successful if workers have a broad educational background. This finding supports the generalist view of the importance of imparting in formal education programs a range of basic skills which are likely to be transferable across a variety of trades and occupations. The importance of training and retraining, especially that carried out on the job, in adjusting to technical change is also emphasized.

The third set of studies examine the relationship between the education levels of workers and managers and the rate at which their organizations adopt new technology. These studies yield no consistent relationship between formal educational background of workers and managers and the technical progressivity of their organizations. There is thus reason to be skeptical of the hypothesis that increased expenditure on formal education would enable Canada to adopt new technology at a more rapid pace.[26]

Together, these three bodies of evidence provide greater support for the generalists' than the technicians' position. They also question the need for major increases in the resources devoted to formal education, except insofar as additional resources are needed to increase the quality of the basic educational curriculum. Indeed, to the extent that formal education can contribute to adjustment to technical change, the greatest

payoff appears to be from a high-quality curriculum imparting basic skills at the elementary (and possibly secondary) school levels.

Technical Change and Deskilling

Underlying much of the evidence discussed above is the fact that technical changes lead to increased demand for some highly skilled occupations but also often create additional demand for routine, low-skilled jobs. Computers, for example, created the need not only for computer programmers but also for key-punch operators and, more recently, data-entry terminal operators. The tendency for innovations in production processes to result in some low-skilled jobs has worried some observers. Two related hypotheses have been put forward. The first, the "deskilling hypothesis," holds that technological change has resulted in a substantial proportion of the labour force being deskilled — performing dull, routine jobs. The second, the "hypothesis of the disappearing middle," relates more to the future than to the past. Its concern is that current and prospective technical changes will eliminate the need for many middle-level skills and occupations, leaving a sharp bi-modal skill distribution in the economy.

Evidence relating to these hypotheses is discussed by Allen (1985) and Globerman (1985). Globerman's evidence, as noted above, is based on the postwar period. This focus has the advantage of there being a large number of studies of the impact of particular innovations. However, there are also important advantages in taking a much longer-term perspective, as does Allen (1985) who provides a detailed discussion of the deskilling hypothesis. Both authors emphasize the difficulty in defining and measuring the concept of skill. For this reason more than any other, the hypotheses remain controversial.

The evidence from the postwar period, as discussed above, indicates that technical change causes deskilling in some cases and the opposite in others. There was no evident tendency for the average level of skill in the labour force, as measured by occupational categories, to rise or fall. Globerman also sees little reason to believe that current and prospective innovations will produce significantly different outcomes from those introduced earlier in the postwar period.

Allen (1985) contrasts two schools of thought on the long-run impact of technical change on the distribution of skills. The human capital school holds that, because average education levels have risen, the labour force has become more skilled. Earnings are positively related to education, holding constant other factors. Employers would not hire the more educated workers if these more highly paid employees were not also more productive. Equating productivity to skill completes the argument. In contrast, radical and Marxist writers such as Braverman (1974) argue that much of the labour force has become deskilled. The definition of

skill used by this school is different; a skilled worker is one who unites the functions of conceptualization and execution of tasks. The farmers and craftsmen of the 1800s were highly skilled workers by this definition. Because they dominated the labour force at that time, whereas today automation has separated the functions of conceptualization and execution (and, indeed, the stages of execution) of tasks for many workers, much of the labour force has become deskilled according to this concept of skill.

It is easy to see that these different definitions of skill are at least partly responsible for the divergent views of these schools on the effect of technical change on the distribution of skills. The introduction of assembly-line production methods may raise worker productivity but lower skill level by Braverman's (1974) definition. Nonetheless, there is more to the debate than different definitions of skill. Allen (1985) discusses the difficulties associated with each school of thought. The role of education is particularly problematic. If, as is claimed by Braverman and others, much of the labour force requires effectively no skill for performing their jobs, why have average education levels risen?

Although the above hypotheses have generated considerable debate, it is unclear that the distribution of skills in the economy should be a major policy concern. It is the level and distribution of human welfare or satisfaction that matter. Job satisfaction contributes to individuals' welfare, but is only one factor. Income is also very important, if not the dominant factor. There are strong incentives in market forces and collective bargaining for "joint optimization"; that is, giving appropriate weight to both productive efficiency (and thus the income generated by the economy) and the social and psychological needs of employees.[27] These forces work through compensating wages, as discussed earlier in the context of layoffs. If the majority of employees prefer variety and autonomy, then firms will have to pay a wage premium to attract and retain workers in boring and repetitious jobs. Firms will only continue to use production lines and job simplification if the gain in technical efficiency more than offsets the additional costs associated with the resulting wage premium. Under competitive market conditions (and in the absence of externalities and other potential sources of market failure) the interaction of employer and employee preferences will yield a socially optimal outcome. That is, the market system tends to maximize the well-being of society, where well-being depends on the satisfaction and income derived from work and the prices of commodities. There will also be a tendency for efficient matching of preferences with job requirements. Workers who have a strong preference for income over job satisfaction will be matched with firms that can produce most efficiently (i.e., at least cost) by assigning highly simplified and routine tasks, and vice versa for those with a strong preference for variety and autonomy. In unionized firms these tradeoffs between income and job satisfaction

are made via collective bargaining. In this case, as discussed previously in the adjustment context, the choices are more likely to reflect the preferences of the older, more senior workers than the younger workers. Nonetheless, with collective bargaining, as with competitive market forces, joint optimization tends to occur. This suggests that unless there are obvious sources of market failure in the determination of skills, the distribution of skills in the economy should not be the focus of policy concern.

A number of possible causes of market failure have been suggested. Marxist writers like Braverman (1974) believe that invention in a capitalist economy is biased toward making work routine. This is part of the process of subjugation of workers in the capitalist system. Allen (1985) assesses this hypothesis. Another possibility noted by Allen is that workers have learned the "wrong" preferences. According to this argument, as work became more routine in the early stages of industrialization, workers put more emphasis on income. As a result, work became even more routine. If more challenging jobs became available, employees would learn to put more weight on job satisfaction and less on income. Although there may be something to this "learning of preferences" view, an alternative explanation is that workers know their desires but these differ from the preferences intellectuals think workers should have.

Deficiencies in management education is another possible flaw in the market system. According to this hypothesis, business schools and other sources of management education put too much emphasis on Tayloristic scientific management techniques, overemphasize subjects such as marketing, accounting, finance and quantitative methods, and underemphasize subjects such as production and human relations. The result is managerial incompetence, local but not global optimization.

None of these arguments seem very compelling, although they may have elements of truth. It is not obvious, therefore, that the observed distribution of skills in the economy is likely to deviate significantly from that which is socially desirable.

A final observation should be added. Much of the speculation about the "disappearing middle" is based on the existing structure of relative wages and prices. But if a substantial decline in demand for middle-level occupations does occur, the relative wage structure will adjust, eventually increasing the relative attractiveness to employers of such occupations and providing an incentive for production innovations which utilize those skills. As stated by Kaliski (1985), even if technical changes are biased against middle-level skills, workers in the future "will have other choices than to become either highly skilled robot and software developers, or unskilled helpers to robots. Middle-skill jobs will continue to exist, although some of them may be relatively less well paid . . . serious thinking about the implications of technology must

take into account such adjustment mechanisms as relative prices and wages."

In summary, there are more questions than answers regarding the effects of technological change on the distribution of skills. However, it does appear that predictions of dramatic changes in the skill distribution should be treated with considerable skepticism. Nor, indeed, are there obvious forces at work which are likely to result in the skill distribution deviating significantly from that which is socially desirable.

Education, Training and Skill Development: Some Policy Issues

The consequences of changing circumstances depend not only on the impact of economic and technical change on the demand for occupations and skills but also on the supply response. This response depends on the institutions of the education and training sector, the choices made by individuals entering or in these institutions, and the on-the-job training carried out by employers and employees. Much of public policy toward education and training operates by affecting these choices and institutional responses. This section discusses policy issues relating to education, training and skill development, drawing primarily on James Davies's (1985) paper in this volume. As before, the focus is on labour market adjustment. Nonetheless, even with this limited focus the issues are many and complex and can only be briefly discussed here.

The previous examination of the role of education and training in facilitating adjustment to change draws particular attention to three aspects: the quality of basic education provided in the elementary and secondary schools; the nature and extent of on-the-job training and retraining; and the adaptability of educational and training institutions to changing labour force needs. These three issues are examined in turn.

Despite the widespread agreement on the importance of a solid foundation in basic reading, writing, communications and computational skills, little is known about the quality of education provided in Canadian schools. This situation is most unfortunate. Standardized testing that would permit comparisons over time, across schools, and across jurisdictions is generally not carried out. The information that is available suggests that the quality of education has remained roughly constant over the past several decades, despite rising real expenditures per student.[28] This conclusion runs counter to the general public perception that the educational fads of the 1960s (less emphasis on "basics," wider selection of courses, less testing) reduced the quality of education. However, it may be that quality simply increased less than it would otherwise have, given the increase in real expenditure per student. In any event, as Davies notes, the recent trend "back to basics" may result in students who are better prepared for the labour force than in the past.

Several significant developments have occurred in policy with respect to training, both institutional and on the job. These changes are in part a response to the disappointing results of training programs in place in the 1960s and 1970s. At the federal level there have been shifts from the support of institutional to on-the-job training and from low-level to high-skill training in institutions. In addition, there is more emphasis on training individuals for the skills and occupations expected to be in greatest demand. Provincial programs, often in the form of wage subsidies, also appear to be increasing in importance. Davies (1985) suggests that these various developments are likely to have beneficial labour market effects.

Historically in Canada there have been much larger subsidies provided to post-secondary education than to training. Many of those entering the labour force after high school receive no direct government support. There is no obvious efficiency rationale for this situation, nor is it equitable since those from middle- and upper-income families are much more likely to attend university than those from lower-income families.[29] The increased support for training and the reduced support provided to universities in the past decade or more can be interpreted as an attempt to redress this imbalance.

Davies (1985) also emphasizes the importance of implicit subsidies to various forms of education and training because of the nature of the tax system. His calculations suggest that when the combined effect of implicit and explicit subsidies are considered, imbalances exist between post-secondary education and training for young workers and between institutional and on-the-job training for older workers. These different rates of subsidy imply that some forms of education and training are encouraged (or discouraged) more than others. Wage subsidies and expanded apprenticeship programs are recommended by Davies (1985) as means of encouraging training among young workers.

Policies to facilitate retraining by older workers have recently received considerable attention. Although the earlier analysis suggests that the need for substantial increases in the amount of retraining may well be exaggerated, there will be some amount. Further, the different rates of subsidy to formal reeducation and retraining versus on-the-job retraining also deserve attention. Three alternative proposals are discussed by Davies (1985):

- the levy-grant scheme, involving a payroll tax on employers, which is used to fund authorized training programs;
- earned educational leave; for example, providing to each worker the right to paid educational leave at the rate of one day for every 30 days worked; and
- the registered educational leave savings plan, which would provide tax incentives for individuals to contribute to a savings fund, which

could be drawn on to fund education or training. Davies's analysis indicates that the levy-grant scheme and paid educational leave proposals have very serious drawbacks. The registered educational leave savings plan, however, has attractive properties.

A variety of policies designed to increase the adaptability and responsiveness of educational and training institutions are discussed by Davies (1985). At the elementary and secondary school level, a voucher scheme or tuition-fee tax credits combined with increased accreditation of private schools are recommended. At the post-secondary education level, changes in financing arrangements — specifically providing federal support directly to students rather than to the universities and colleges — are suggested. These changes in existing arrangements would have profound implications and deserve careful study and consideration.

Conclusions

This overview paper and the background papers which follow deal with an important and complex set of issues. The primary purpose has been to explain the current understanding of labour market adjustment in Canada and to assess policy proposals. If the reader's understanding of phenomena such as layoffs and plant closings, technological change and unemployment, and the role of education and training in adjusting to technological and other changes has been increased, the volume will have achieved its main objective.

A variety of detailed conclusions and recommendations appear in the individual sections of this overview paper and in the background papers which follow. The following are particularly prominent:

- Adjustment to change raises the average level of well-being in society. Except when changes are clearly temporary, adjustment should be encouraged for this reason.
- Substantial structural adjustments have occurred throughout the postwar period. Some of the unemployment observed in the economy at any point in time is associated with structural adjustment. However, the hypothesis that the increase in unemployment in the last two decades can largely be attributed to an increasing rate of structural adjustment does not receive substantial support.
- Although adjustment policies can be justified on efficiency and equity grounds, probably their strongest rationale is that in their absence political pressures would result in policies which inhibit adjustment and harm society as a whole.
- Policies to facilitate adjustment should focus on the provision of assistance to workers rather than firms.
- Adjustment assistance policies will have some adverse consequences. These policies provide insurance against risks associated with

change, thus encouraging firms and workers to take more risks. These policies also tend to supplant private market responses to these risks, raising the cost of publicly funded programs. Intelligent design of adjustment assistance policies is needed to minimize these adverse effects.

- Concerns about technological change causing widespread unemployment appear to be without foundation. Technical changes tend to create as many or more new employment opportunities as they destroy.
- Technical change does not appear to raise (or lower) the average skill level demanded by employers or to result in the need for a more highly educated work force. Thus, the case for a dramatic increase in resources devoted to formal education because of the prospect of rapid technological change is weak.
- Most cognitive job skills are acquired on the job. Formal education can contribute to the acquisition of these skills and to adjustment to changing skill requirements by providing a solid foundation in general skills such as reading, writing, communications and computation.
- Despite its evident importance, little is known about the quality of education provided in Canadian elementary and secondary schools.
- Hypotheses about the effect of technical change on the distribution of skills remain controversial, in part because of different concepts of skill. Although innovations have created demand for many highly skilled occupations, they have also resulted in many dull, repetitive jobs. Whether this should be a policy concern is unclear. There are no obvious sources of market failure that would cause the skill distribution to deviate significantly from that which is socially desirable.
- Education and training play significant roles in adjusting to change. Although it is difficult to determine whether the overall level of expenditure is appropriate, some reallocation of existing expenditure between post-secondary education and training and between institutional and on-the-job training should have beneficial labour market effects. Public policy has already been moving in the recommended directions. Policies to increase the responsiveness of educational and training institutions to changing enrolment patterns also deserve careful study and consideration.

Notes

This study was completed in January 1986.

1. A Pareto improvement in social welfare occurs if some individuals in society are made better off without others being made worse off. This may require compensating those who are adversely affected by economic change. A potential Pareto improvement occurs when it would be possible to make some individuals better off without making others worse off. The Pareto criterion thus requires that the net benefit to society be positive; that is, after compensating (or contemplating compensation in the case of potential improvements) the losers, there must remain some who benefit from the change.
2. For a more formal statement of the basic economics of adjustment see Harris, Lewis, and Purvis (1984).
3. Conceptually, there is a clear distinction between temporary and permanent layoffs, although as noted above there will in many cases be considerable uncertainty about whether recall will occur. For data purposes the division, when it is made, is quite arbitrary, 13 weeks being the dividing line.
4. See also Abraham and Katz (1984) and Riddell (1984).
5. They use a 12-sector breakdown for the period 1948–82, and a substantially more disaggregated breakdown (180 industries) over the period 1962–79. See McFetridge (1985a) for a further discussion of this study and others relating to the adaptability of Canada's industrial structure.
6. Indeed, during the past 15 years studies of unemployment have emphasized the magnitude of labour market turnover — the fact that flows between labour force states (employment, unemployment, out of the labour force) are large relative to the stock in each state. For further discussion of the relationship between labour market turnover and unemployment see Kaliski (1985).
7. As Gunderson notes, the observation that unions tend to provide greater employment security to older, more senior workers at the expense of exacerbating the adjustment problems of younger, more junior workers may be viewed as equitable in that older workers are more likely to have made fixed investments contingent on their job (house, family, community).
8. For a further discussion of the role of unions in providing a collective "voice" see the overview paper in Riddell (1985b) and the references given there.
9. See note 1 for an explanation of the meaning of (Pareto) efficiency. If market outcomes are inefficient, then it is possible to improve the well-being of some individuals even after compensating any individuals harmed by adopting the efficient outcome.
10. Davies's discussion of these matters is carried out in the context of education and training while Gunderson's is couched in the context of permanent layoffs and plant closings. However, the general principles explained in each paper apply more broadly to other aspects of adjustment.
11. This does not constitute a complete list of the potential sources of market failure that have been discussed, but it is a "short list" of the main contenders. See Davies (1985), Gunderson (1985), and Trebilcock (1985a, chap. 1) for a discussion of others.
12. For a discussion of pecuniary externalities — the existence of which does not constitute a market failure — see Gunderson's (1985) paper in this volume.
13. For an assessment of the current Canadian situation with respect to a variety of innovative personnel practices, mostly involving increased employee involvement in enterprise decision making and a more cooperative approach to labour-management relations, see Riddell (1985c).
14. Employees earning wages in excess of their alternative wage — perhaps because of previous specific human capital investments or because of unionization — have an incentive to make either temporary or permanent wage concessions, providing these are needed to maintain the enterprise's viability. However, asymmetric information about the firm's true financial state and strategic behaviour on the part of both parties (firms may use the threat of bankruptcy to try to extract concessions; unions may view concessions at this firm as the "thin edge of the wedge" leading to concessions elsewhere) may prevent this outcome from being realized.

15. The consequences of adjustment policies are discussed below. With respect to bankruptcy provisions, in particular wage claims under bankruptcy, see Gunderson's (1985) paper in this volume.
16. See the overview paper in Riddell (1985a) for a further discussion. In this case an additional reason for the absence of private insurance markets is the largely non-diversifiable risk associated with the business cycle. The idiosyncratic nature of many risks implies high transactions costs which can also prevent private insurance markets from arising.
17. Owners of small businesses may also have difficulty reducing the risk of fluctuations in their wealth through diversification because shares in the business may not be marketable.
18. The case of unemployment insurance is discussed further in the overview paper in Riddell (1985a). Compulsory coverage deals with the adverse selection problem. Empirical evidence supports the view that moral hazard considerations are not minor in significance. The relationship between Canada Employment Centres and unemployment insurance may facilitate dealing with the moral hazard problem.
19. See McFetridge (1985a, 1985b) for discussions of technological change in the context of industrial structure and industrial policy.
20. For example, how many people make the connection between the rapid productivity growth in agriculture in the postwar period and the rapid growth in employment in the service sector during this period?
21. Allen (1985) notes several previous periods in which such concerns were widespread.
22. The supply of labour to the economy as a whole appears to be fairly inelastic. Even a modest amount of competition in product and labour markets would make a large shift toward profits in the functional distribution of income unlikely.
23. Allen (1985) notes, however, that "During the early phases of modern economic growth, per capita income increased but real wages may well have been constant."
24. Of course, we could debate whether this would be a wise policy. The analysis of this section suggests that allowing technical progress to occur combined with an adjustment assistance policy would probably be the better choice.
25. The distinction between "generalists" and "technicians" can be overdone. As Globerman (1985) notes, "most arguments stressing the emerging skill-specific demands of technological change tend to acknowledge a need for more extensive (or at least more effective) education in basic skills as well." Nonetheless, the emphasis of the two groups does differ, which implies that, faced with limited resources, they would allocate these resources differently.
26. This does not reject the possibility that shortages in some highly skilled occupations may slow down the rate of diffusion of innovations. Globerman (1985) cites the example of a shortage of systems engineers and programmers affecting the speed of adoption of electronic data processing by insurance companies.
27. The points raised here are also central to the issues of quality of working life, employee participation, and industrial democracy. See Riddell (1985c) for an assessment of the current Canadian situation in these areas.
28. See Davies (1985) and the references cited there. Quality appears to have improved in some areas (e.g., science), and decreased in others (e.g., language).
29. The high subsidies to universities (and thus low tuition fees) can be justified on equality-of-opportunity grounds. However, as Davies (1985) notes, there are alternative methods of promoting equality of opportunity.

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Formal Education and the Adaptability of Workers and Managers to Technological Change

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Over the past decade, relatively high rates of unemployment and low rates of productivity growth have refocussed the attention of policy makers on issues that arise from technological change. One of the most prominent of such issues is the relationship between technological change and education patterns in today's society.

At least two aspects of this relationship have received fairly widespread attention. One is the contention that declining quality standards in education have contributed to a slowdown in North American productivity growth rates. This has been addressed elsewhere and will not be considered further in this study, except indirectly.[1] The other concern is that technological change is destroying job opportunities for all but those with particular educational backgrounds. The potential gravity of the emerging technological unemployment problem is dramatically expressed by McCallum (1983, p. 16):

> By the turn of the century, millions of jobs [in North America will be wiped out by] robotics, office of the future technology, automatic factories and . . . other . . . innovations. . . . [But] lost jobs are only the beginning. Most jobs that do survive will be barely recognizable meaning the incumbents will have to go through wrenching retraining and re-adjustment programs.

The subject matter of this study can be viewed as a subset of the broad technological unemployment issue. Specifically, the study examines the hypothesis that the adaptability of workers and managers to technological change is a function of their formal educational backgrounds.

The relevance of this hypothesis to policy makers' concerns about technological unemployment is obvious. To the extent that workers and managers who are better educated (in some meaningful sense) have

more "malleable" skills, they are less likely to suffer prolonged periods of structural unemployment consequent to the introduction of specific labour-saving innovations. More directly, the future employment prospects of workers and managers will be improved if the skills they acquire through the educational process are complementary to technological innovations being introduced into the economy.[2] Given either educational opportunity, workers and managers are less likely to resist new technology, and faster productivity growth in the economy can be expected as a result.

Formal Education and Adaptability

Before offering a formal specification of the adaptability hypothesis and suggesting indirect tests of that hypothesis, it would be both useful and interesting to review some positions enunciated in the public policy arena that bear on possible relationships between education and the capacity of workers and managers to respond to technological change. Opinions seem to divide sharply on the length of time spent in the formal education system and on the nature of the subject material studied. In fact, most of the recent interest in the relationship between education and labour's adaptability to technological change has focussed on the "appropriate" educational curriculum.

The Generalists

One broad perspective on the relationship between education and technological change might be denoted as the generalist position. Proponents of this position emphasize the importance of enhancing an individual's ability to reason critically, to solve problems and to learn. A summary statement of this position is offered by Ehrenholt (1983, p. 43):

> If anything, the character of work is continuing to become less routine, more problem-solving, and above all, more changeable. That requires a mobile, flexible, adaptable labor force. The ability to learn will, in my view, emerge as the premium skill of the future.

Ehrenholt's position is echoed by Bandeen (1983, p. 184), who suggests that "the most important thing an individual has to learn is how to learn."

While there is no consensus on the precise components of a general educational background, most observers tend to include basic reading, writing, communication and computational skills. The core of the generalist curriculum is therefore rooted in a firm grounding in languages, mathematics, science, social studies and computer science. Some recent contributions to the literature, reviewed in O'Donnell (1983), stress the need to equip students with skills that go beyond these basics — that is, so-called higher order cognitive and decision-making

skills. But the precise components of a curriculum that would contribute to such skill formation is unclear.

The Technicians

Another position taken in the educational curriculum debate might be identified as the technicians' position. This view tends to hold that emerging skill requirements in the labour market are fairly specific and technical in nature and that more emphasis should be placed (in educational programs) on practical preparation for specific occupations or clusters of occupations. In this regard, several representations to the Royal Commission stressed the need for Canada's educational system to reemphasize technical training in school curricula, especially in skill areas affected by the microelectronics "revolution."[3] Furthermore, a recent study, conducted by the Ontario Institute for Studies in Education from results of a Gallup Poll and discussed in Dawson (1983), found that 58 percent of respondents wanted universities to place more emphasis on job-oriented programs. Implicit in the technicians' position is a presumption that emerging skill requirements are capable of being forecast.

To some extent, the technicians' position reflects a preference for more emphasis on vocational education as opposed to general schooling. The difficulties associated with making distinctions between vocational and general schooling are well known and are reviewed by Weiermair (1983). The focus of this paper is restricted to what we conventionally define as elementary, secondary and post-secondary institutions, as distinguished from colleges of applied arts and technology and programs of on-the-job training.[4] Nevertheless, the distinction between the positions taken by the generalists and the technicians is still relevant, since a significant component of post-secondary education might be considered "occupational" in nature — for example, engineering and business curricula. Moreover, a growing number of researchers (see O'Donnell, 1983) concerned with education for the "post-industrial" economy have suggested that general training will need to be buttressed by technical literacy, which includes competence in manipulating various forms of media encompassing print, aural, visual and computer communications.

To be sure, most proponents of both the generalists' and the technicians' positions have emphasized a need for governments in Canada to give greater priority to education.[5] The distinction between the positions is, therefore, more a matter of which components of the formal education curricula should be emphasized. In particular, some participants in the curriculum debate have stressed the special importance of science and computing programs in our schools. For example, the Science Council of Canada (1984) has stressed that excellence in science and technology is essential for Canada's successful participation in the infor-

mation age, and that Canada's youth must have a science education of the highest possible quality. Others have especially lamented the "shortage" of university-trained engineers and managers.[6] While generalists acknowledge the importance of science, mathematics and computing science in basic educational curricula, they do not necessarily give these areas a higher priority than other basic subjects such as languages, history and social studies.

This distinction in positions is perhaps most starkly evident in the juxtaposition of the following quotes. John Roth, president of Bell Northern Research Ltd., was recently quoted as saying: "Part of the extremely successful Japanese strategy has been to encourage students to go into engineering and the sciences and we must do the same."[7] At about the same time, Larkin Kerwin, president of the National Research Council, suggested that: "We're graduating specialists in technological fields and the technology is quickly outdated. The specialists are left with no jobs, and they do not take kindly to having to be recycled to learn something else." Mr. Kerwin also criticized the high schools for trying to teach too much science. For instance, he indicated that teachers are misguided in saying that every child should learn to program a computer, since the machines are like telephones that people learn how to use without knowing how they work.[8]

These positions, while by no means comprehensive, suggest the empirical issues dealt with in this survey. Specifically, the study is concerned with evaluating claims that emerging patterns of technological change are creating a serious gap between skills available in the workplace and skills desired by employers, and that substantial changes in the extent and nature of formal education are required to bridge this gap.

The Education-Adaptability Hypothesis

The underlying framework for the review of the literature in this study can be conceptually cast in terms of activity analysis. Specifically, we may think of any occupation in the labour force at any given time as being describable by a set of minimum skill requirements. Therefore, the composite of skill requirements can be defined across all occupational categories in the work force.

More formally, we can define a skill-requirements matrix [A] as:

$$\begin{matrix} A_{11} & A_{12} & \cdots\cdots & A_{1n} \\ A_{21} & A_{22} & \cdots\cdots & A_{2n} \\ \vdots & \vdots & & \vdots \\ A_{n1} & A_{n2} & \cdots\cdots & A_{nn} \end{matrix}$$

where each column of the matrix reports the set of "skill coefficients" required for a "unit level" of a specific occupation. For example, column 1 might represent the skill requirements for one person-hour of mechanical drafting services of a minimum or "average" level of competence.[9] Thus, element A_{11} might represent an index-based coefficient of required reading literacy; A_{21} might represent an index-based coefficient of numerical literacy, and so forth. In like manner, the second column of the matrix might represent skill requirements for a second occupation, for example, systems programmer.

Skill-Related Effects of Technological Change

Within such a framework, technological change can induce changes in the economy-wide demand for specific skills either by directly encouraging changes in the elements of the [A] matrix, or by altering the distribution of demand for various occupations. One manifestation of the adoption of new technology is a change in the skill requirements within occupations; in any column, some A_is increase, while others decrease. In more extreme cases, some A_is may become zero-valued, while "new" skill requirements emerge; that is, additional rows in the [A] matrix are created. Still a third possibility is for the elements of one or more columns in the matrix to change monotonically — to increase or decrease uniformly — although not necessarily equiproportionally.

While it is not a direct concern of this paper, it is worth noting briefly that the concept of skill is an elusive one to define and measure. There is a fairly rich literature on the conceptual and practical problems involved in specifying dimensions of skill in the workplace which, as a practical matter, cannot be reviewed here.[10] However, it is important to emphasize that occupational categories are usually quite broad and encompass job classifications with a great range and disparity in training and educational requirements. This is a relevant point, since much of the evidence on the impact of technological change implicitly relates changes in occupational categories to changes in underlying skill requirements. In fact, the latter changes may be very imprecisely linked to the former.

It is also worth emphasizing that job classifications (by education level, task complexity or other dimensions) are not invariant. Rather, they may adapt to changes in the economic environment and in the requirements of organizations.[11] One implication is that any given job might be accomplished with a variety of substitutable skills, albeit at different costs for any given set of factor prices. Another is that personnel problems created by specific changes in skill "requirements" may be mitigated by redesigning the jobs affected.[12] The simple activity analysis framework outlined above ignores these complexities; however, it should be emphasized again that it was included primarily for expository

purposes. Nevertheless, in reviewing the relevant evidence, such qualifications must be borne in mind.

Continuing with the model, we assume that demand levels for different occupations can be expressed in the form of an (n x 1) column vector (Q_i). The derived demand for skills in the labour force is conceptually the product matrix of dimensions (n x 1), denoted as [D_i], where:

$$[D_i] = [A]\,[Q_i].$$

Thus, the D_i vector measures the "quantity demanded" of specific skills at any point in time. Presumably, there is also some distribution of acquired skills in the workplace, which may be thought of as the potential supply of specific skills [S_i]. We note explicitly that the supply of skills is not necessarily identical to the supply of labour in different occupations. For example, virtually all members of the work force, regardless of occupation, possess some level of verbal literacy, hence they all contribute to the potential supply of "verbal literacy" skills.[13]

At some set of relative prices, the market for skills will clear if:

$$[D_i] - [S_i] = 0,$$

that is, if there is neither excess demand nor excess supply for specific occupational skills.

In this stylized description, therefore, technological unemployment might be viewed as the excess demand for specific skills (mirrored by excess supply for other skills) created by the introduction and spread of technological innovations. This situation is distinguished from that in other models which emphasize a deficient overall demand for skills caused primarily by the introduction of labour-saving innovations.[14] In our model framework, such "aggregate" technological unemployment would be induced by parametric decreases in [Q_i] for any given [A], and excess supply would emerge for most specific skills over time.

Formal Education and Technological Unemployment

Conceptually, formal education largely represents an ex ante investment in human capital. That is, most of the "skills" are created prior to the investor's entrance into the work force, whereas vocational retraining programs may be seen as ex post responses to the emergence of supply and demand imbalances. Within the context of this model, the two forms of investment are alternative ways to promote convergence between supply of and demand for skills in the market.

Hypotheses regarding the relationship between formal education and adaptability may now be integrated into the foregoing activity analysis framework. Specifically, the generalists may be seen as arguing that

most skills required in the workplace over time are relatively trivial modifications of a fairly limited set of basic skills. Therefore, equipping potential entrants to the work force with "sufficient" quantities of basic skills effectively increases elasticities of supply for specific skills. That is, workers in one occupation possessing a basic set of skills can easily and quickly shift to another, even though the vector of skills required in the latter is not identical to that required in the former.

Presumably, wage and price adjustments would elicit supply and demand responses sufficient to clear markets for skills in the long run. However, given private adjustment costs, together with institutional and legal rigidities that hinder wage and price changes in the economy, conditions of excess demand for certain skills and excess supply for others could persist for extended periods of time. Since the required wage and price adjustments would be reduced by increased elasticities of skill supply, increased basic education can be seen as contributing to a faster convergence between supply and demand for any set of required skills.

Within the conceptual framework outlined above, the technicians may be seen as arguing that technological change creates the need for idiosyncratic skills which cannot be easily met by adapting basic skills extant in the work force. Rather, the demand for specialized skills must be anticipated (or at least quickly recognized) and produced in the educational system, ideally in advance of significant increases in demand, so as to avoid a prolonged divergence between supply and demand. In fact, however, most arguments stressing the emerging skill-specific demands for technological change tend to acknowledge a need for more extensive (or at least more effective) education in basic skills as well.

Testing the Hypothesis

A hypothesis that more and better education will contribute to faster adaptation of the work force to technological change borders on being axiomatic. It is difficult to argue that an increase in the (quality-adjusted) intensity of educational services provided to Canadians will fail to enhance their capacity to work with and manage new technology, at least on the margin. The more pointed, and policy-relevant, issue is whether the benefits of a substantially increased commitment of resources to formal education will outweigh the opportunity costs of those resources. While this might seem a fairly tractable empirical issue on the surface, in practice it is plagued with various conceptual and statistical problems, many of which are discussed in the literature dealing with estimating the productivity returns to human capital.

In evaluating the relatively narrow relationship between formal education and technological adaptability, we immediately confront the issue of how to specify and measure "technological adaptability" for purposes of

statistical analysis. The conceptual definition offered in the preceding section was for heuristic purposes and offers no realistic prospects for implementation. Hence, the researcher must settle for examining a set of variables that are both capable of being fairly readily measured and that are plausibly related to — if not coextensive with — technological adaptability. A complementary approach involves examining some of the relationships that ultimately qualify the empirical relevance of any linkage between formal education and technological adaptability.

One such qualifying relationship is between technological change over time and changes in the required occupational skill mix of the labour force. For example, if technological change leaves the distribution of demand for required occupational skills relatively undisturbed, the imperative for social overhead investments in formal education to facilitate transitions in the available skill mix is seriously weakened.

A second important link in the education-adaptability argument is the relationship between required occupational skills and changes in educational requirements. That is, if educational attainment is only weakly related to the satisfaction of demand for general or specific occupational skills over time, it becomes less likely that additional investments in formal education will significantly contribute to a faster convergence between supply and demand for any set of required skills.[15] In the next two sections, we examine some evidence bearing on each of these relationships.

Technological Change and Required Occupational Skills

The relationship between technological change and required skills encompasses both changes in skills required for given occupations and the relative change in demand for the occupations themselves. As noted in the preceding section, occupational categories typically encompass job classifications with a great range and disparity in training and educational requirements. Smith's (1981) argument that the imposition of different training and educational requirements is often inappropriate and inefficient, when considering a broad range of technical and professional occupations, only strengthens the conclusion that changes in the relative importance of various occupational categories are, at best, imprecise proxies for corresponding changes in the relative importance of different skills. Furthermore, the number of relevant studies is quite large and the methodologies followed are quite diffuse, which makes summary interpretation of results even more difficult.

Early Postwar Experience with Automation

The large-scale introduction of electronic equipment into the workplace in the 1950s and 1960s led to grave concerns about "technological

unemployment" and to a host of studies that examined the impact of factory automation on occupational structure and skill requirements.

One conclusion common to most studies is that technological change does not necessarily result in a net "upgrading" or "downgrading" of work-force skill requirements to a major extent. This was the conclusion of Bright's (1958) early and seminal study of changes in skill requirements and shifts in the occupational structure in 13 of the most advanced production systems implemented in the mid-1950s. It was also the conclusion of Crossman and Laner's (1969) well-known case study of a sample of U.S. companies in various manufacturing and service industries. More specifically, Crossman and Laner found that there was little or no net overall tendency for the mean skill level of the work force to increase with technological change.

Perhaps the most sophisticated evaluation of the overall skill impacts of new technology over the period of the 1950s and 1960s is found in Scoville (1969). In his study, the U.S. Employment Service's estimated job-related characteristics for a sample of 4,000 jobs were incorporated into a statistical model, and monetary values were estimated for the various characteristics. Employment service personnel rated the job descriptions (not observed jobs) by levels of general and specific training required, and the aptitudes, interests, temperaments and working conditions that characterized each worker-job relationship. Examples of the characteristics identified include general intelligence, verbal ability, numerical ability, spatial perception and motor coordination.

Using the estimated monetary values of different job characteristics, Scoville aggregated census occupations into five content groups, where higher level groups enjoyed higher "monetary-equivalent" characteristics. For the period 1940–60, he found the share of the top three job-content groups rose in the U.S. economy. This rise especially reflected the growth of professional services and administration. He also found that shifts in occupational distribution were related to a gradual rise in required levels of general education and specific training. Scoville's findings, therefore, suggest an upgrading in required skills (including required education) over his sample period; however, the observed changes were relatively modest. For example, the percentage of the work force employed in occupations assigned to the top three job-content groups increased from 44.2 percent in 1940 to 57.3 percent in 1960, or 1.3 percent per annum. The average number of years of general education required increased from 9.99 in 1940 to 10.37 in 1960.

While one might argue about the use of socio-economic classifications of skill levels, the main point is that there was apparently no broadly based move of occupational demand away from so-called lower skilled jobs to higher skilled jobs, or vice versa. Nevertheless, the modest mean impact of technology can obscure significant and countervailing changes affecting specific segments of the labour force. In this regard, a survey of

281 industrial situations by the New York State Department of Labor (1969) found that the replacement of one type of machine by another was accompanied by upward skill changes in some cases and by downward changes in others; however, the number of no-change cases was numerically the most important.

In another study, Herman (1970) examined the employment impact by skill and education level of the introduction of computers to direct control of industrial production processes and manufacturing operations in six process industries using a 12-plant case study. The main impact observed was on the modification of job duties within the plant leading to some modest job creation at higher skill levels and virtually no change in demand conditions at the lower skill levels. In a related study, Whisler (1970) examined the early impact of computerization on skill requirements in 19 large insurance companies. He found that skill changes were most pervasive at the clerical level, diminishing at successfully higher levels. An apparent anomaly was provided by the observation that clerical jobs became more routinized, while at the same time, there was an apparent upgrading in clerical skills. Whisler suggests that this seeming anomaly can be resolved by the observation that greater demands were being placed on employees for greater reliability in performance, albeit in a more routinized set of activities.

Reviewing case studies of several British industries — agriculture, coal mining, textile machinery, cement, metalworking and machine tooling — Rothwell and Zegveld (1979) conclude that in most instances, the adoption of new manufacturing technology has meant some deskilling in certain craft areas and the generation of new, "higher level" skills in others. In particular, the successful adoption of new technology has typically imposed greater skill requirements on management and has increased the need for managers to acquire technical skills. They argue that this tendency has been especially pronounced in the case of electronic controls in manufacturing, where new, high-level electronics and software skills have been required, while some craft skills have been made largely redundant. The two authors argue that the application of microelectronics will intensify both these trends in the manufacturing sector.

A recent study by Denny and Fuss (1983) investigated the effect of automation on the occupational demand for four categories of labour in Bell Canada: telephone operators, plant craftsmen, clerical workers and white-collar employees (a residual group). The measure of technological change was the percentage of telephones installed that had access to direct distance dialing. They found that technical change was capital-using and labour-saving, with the labour-saving impact being felt most severely by the least skilled occupations. The impact was least significant for white-collar workers, presumed to have higher skill levels.

In summary, while a number of studies identify non-neutral skill-

demand impact of technological change, there is no clear pattern to the observed biases. This is the conclusion that Horowitz and Herrnstadt (1966) come to in their comprehensive review of over 500 bibliographic titles published between the early 1950s and mid-1960s on the effect of technological change on the skill requirements of jobs. Specifically, they conclude that one cannot generalize about the effects of (automation and) technological change upon job content and skill requirements, except to say that they differ from case to case.

The absence of any strong consensus on the specific skill-demand impact of technological change is not entirely surprising. The relevant studies employ different research methodologies, cover different industries for different time periods, and are subject to the influence of institutional factors, such as government policy and union restrictions, that vary from industry to industry and country to country. But the lack of uniformity in the empirical studies surveyed need not be solely the result of differences in research design and implementation. To the extent that technological change is at least partly endogenous to relative factor prices, its skill-demand impact will be influenced by the relative scarcities of various skills. Where scarcities differ across industries, or within industries over time, one might expect to observe variation from study to study in the impact of technological change on the demand for skills.

More Recent Experience

Widespread concern about massive job displacement and non-neutral impact on desired skills has more recently sprung from the diffusion of microprocessor-based innovations. In one expression of concern, Clegg (1984) argues that the ways in which organizations appear to have adopted and adapted to computers and other components of automation represent an overwhelming trend toward work simplification. Others such as Kuttner (1983) argue that the impact of recent technological change is to alter the occupational distribution by upgrading some skills and downgrading others in such a way that the middle levels of the structure are substantially eroded. Since there is some concern that the "microprocessor revolution" represents a discontinuity in historical patterns of technological change, it is important to examine critically the available evidence bearing on this claim.

Unfortunately, relevant empirical studies of the skill impact of recent technological change are limited in number and suggest no unambiguous conclusions. One new technology that has received attention is robotics. For example, Faulkes and Hirsch (1984) report the experience of an aeronautical manufacturer who found that the manual drilling and routing job which the company was automating through robotics required the driller to have excellent perceptual and motor coordination, whereas a robot

operator would need cognitive and communications skills. As monitor and controller, the operator would have to dictate the robot's processes and communicate well with programmers, maintenance staff and others in the system. Faulkes and Hirsch thereby suggest that the introduction of robotics is imposing demands upon workers to enhance their problem-solving, reasoning and analytical skills.

At the same time, Hunt and Hunt (1983) argue that robot software packages, like other computer software packages, are made to be "user friendly." Their interviews indicated that robotics technicians and others with similar skills can learn quickly to program robots with specific routines and, in fact, are doing so as part of their regular duties. Highly skilled computer specialists are required to develop the general software packages for robots, and requirements for interfacing the robots with plant equipment will increase the complexity of robotics software. Hence, they argue that robotics implies a skill-twist whereby semi-skilled and unskilled jobs are displaced, while highly technical jobs are created. But given that reprogramming will be infrequent, the increase in highly skilled positions will remain small.

An Organisation for Economic Co-operation and Development (1984, p. 39) conference report places less emphasis on the skill-upgrading characteristics of robotics technology, while acknowledging that certain skilled crafts, for example, welding, will be displaced. It agrees with Hunt and Hunt's assessment that the bulk of the new jobs created will essentially involve "babysitting" robots. In short, there is no obvious consensus regarding the likely skill-related effects of robotics on the bulk of the work force potentially affected by its implementation. The early evidence suggests, however, that the bulk of whatever skill changes do occur can be readily accommodated without significant displacement of existing workers. An example is provided by Chrysler Canada Ltd., which established its own robotics training centre for skilled trade workers who were subsequently assigned to operating, repairing and programming the robots.[16]

Assessments of the skill-related impacts of computer-aided design/computer-aided manufacturing (CAD/CAM) parallel those of robotics to some extent. For example, Peitchinis (1980) notes that numerically controlled (NC) machine tools produce at a substantially faster pace than the processes they replace. Furthermore, they perform with greater precision than could be expected from instrument-assisted skilled workers. As a result, it is no longer possible to rely on long experience and intuition, two of the mainstays of manually operated and assisted production processes. He concludes that all levels of personnel have to become more precise and less qualitative in their work activities.

The implications of any such skill changes for the composition of the labour force — as in the case of robotics — appear to be fairly modest. For example, Isherwood and Senker (1978) conclude that the proportion

of skilled craftsmen in the labour force has apparently not been much affected by the increasing use of NC machine tools in Britain's engineering industry. Gennard and Dunn (1983) found, however, that the introduction of computerized printing techniques resulted in craft workers declining in importance, as technicians, technologists, estimators, computer operators and other non-manual occupations became more prominent. These seemingly contradictory findings might be reconciled by acknowledging that managers in different industries and, indeed, in different firms within industries, may disagree in their estimates of how "fungible" any given set of skills is in different production settings. Thus, where management believes that traditional craft skills can be readily modified to those appropriate for working with microprocessor-driven equipment, the displacement of craft workers by other occupational groups might be quite modest, as it apparently has been in the previously cited case of Chrysler Canada Ltd.

In reviewing various recent studies of implications of new technology on the labour market, the problems created by examining occupational shifts as a proxy for shifts in skill requirements become apparent. Specifically, to the extent that the elasticities of substitution across critical skills in different occupations are high, substantial shifts of labour across occupational categories may not necessarily imply significant supply/demand imbalances for sets of work-force skills. While some "reconstituting" of existing skills may be required, astute management may be able to effect skill substitutions at relatively low cost.

With regard to skill substitution in computer-aided design, an OECD (1984, p. 23) case study of its use in the glass industry found that individual designers who show a normal degree of flexibility in their everyday work have no problem adapting to the use of cathode-ray tubes (CRTs) and light pens from paper and pencils. However, some designers without a sufficient geometrical background were not able to adjust and could not master the use of CAD. The training period consisted of one week spent learning the system and two weeks involving close, but decreasing, supervision of production work.

The basic theme that microprocessor-based technology alters the desired skill set in the work force, but in ways that can apparently be characterized as continuous rather than discrete, is also suggested by early experience with office communications systems and with automating financial services. For example, the OECD (1984, pp. 17–20) case study of office communications systems concludes that office automation is not necessarily widening the "skills gap" between secretarial/clerical and professional/technical staff, although workers currently in the former occupations must be prepared to upgrade their level of computer literacy on an ongoing basis.

In summary, recent experience tends to be consistent with the earlier postwar experience with technological change. Specifically, occupa-

tions are not impacted in identical fashions, and supply/demand balances are altered for different job-related skills or attributes. Nevertheless, the impacts tend to be marginal rather than dramatic in nature, thereby facilitating continuous rather than discrete adjustments to the disequilibria created. The basic perspective is captured in Peitchinis's (1978) study of 104 Canadian companies, in which he concludes that technological changes have not caused any critical manpower problems. More specifically, few skills are being rendered redundant, and those workers with skill attributes that are being displaced are accommodated into alternative employments, frequently after some relatively brief training.

The foregoing review of the skill-related impacts of technological change clearly admit the importance of retraining workers to work effectively with new production techniques. However, the implications for policies on formal education are less clear, except that it is unlikely that recent technological changes are creating unprecedented demands for skills beyond those imparted in traditional primary, secondary and post-secondary institutions. In the following section, available evidence that bears more directly on the link between technological change and "required" educational backgrounds is evaluated.

Required Skill Changes and Education

Fewer studies deal with the relationship between required skill changes and education than with the relationship between technological change and required occupational skills. There is a fairly substantial degree of agreement, however, that technological change has not been consistently linked to a need for more workers who are more highly educated, or for that matter, more technically trained.

Some Relevant Studies

One relatively early study representative of the findings of the relevant literature is Rawlins and Ulman's (1974) analysis of 459 professional and technical occupations. They found a rather consistent increase in educational attainment over the period 1950–60 that bore no statistically significant relation to the changes in estimated technical skill requirements. For a similar time period, Collins (1969) studied the relationship between changes in the actual skill requirements of jobs, as a result of technological change, and educational requirements. He found no difference in educational requirements between organizations that reported a rise in skill levels as a result of technological change and organizations in which skill levels remained the same. For example, in local and highway passenger transportation, the output per worker changed less than

1 percent per year, while in coal mining, output increased over 5 percent annually. But the percentage of blue-collar workers who were high school dropouts remained virtually the same in each industry over the sample period 1950–60. Furthermore, in those instances where technological change resulted in changes in skills required on the job, the retraining involved did not necessitate additional years of schooling. Generally, such retraining was handled on the job within a period of a few weeks.

One ubiquitous finding is that most cognitive job skills, general or specific, are acquired either formally or informally on the job after a worker wins an entry job. For example, in the 1960s the President's Commission on Automation undertook extensive surveys on how workers learned the actual cognitive job skills they used. As reported in Thurow (1977), only 40 percent of the respondents reported that they used skills acquired in formal training programs or in specialized education. Most of them had acquired their skills in informal, on-the-job training. Even among college graduates, over two-thirds reported that they had acquired cognitive job skills through informal, on-the-job processes. Perhaps the most convincing evidence came from workers asked to list the form of training that had been most helpful in acquiring their current job skills. Only 12 percent listed formal training and specialized education. Other studies supporting this general finding are discussed in Squires (1977) and Whiston et al. (1980).

This result is broadly in line with Scoville's (1969, p. 69) survey results for 1963, in which approximately 30 percent of respondents reported that they used skills acquired in formal education in their current jobs. It is worth noting, however, that about 55 percent of respondents in Scoville's top two occupational levels indicated that they used skills acquired in formal education in their current occupations.

In a related study, Mueller (1969, p. 179) surveyed over 2,500 workers, representing a cross-section of the U.S. labour force in 1967, in an attempt to assess the effects of technological change between the years 1962 and 1967. Respondents were asked: "In order to work with [the] new equipment, did you have to learn anything new or did you acquire any new skills?" and "How did you acquire the new skill or knowledge . . . ?" Over 42 percent reported no need for training, 46 percent either trained themselves or were trained by someone else on the job, and 5 percent were trained through a combination of formal courses and on-the-job training.

We should not necessarily jump from these studies to a conclusion that formal education is unimportant in creating a work force that is adaptable to technological change. In particular, it can be argued that "embodied" formal education facilitates workers' on-the-job efforts to adjust to technological change. The surveys cited above were presum-

ably not designed to identify contingency relationships between different vehicles for acquiring occupational skills.

The hypothesis that formal education is complementary to on-the-job adjustments to technological change is supported in a study by the International Labour Organization (1977) of employment trends in postal and telecommunications services. Specifically, the ILO found that the use of new techniques in these areas was accompanied by variations in vocational training requirements. In some cases, improved equipment called for highly skilled staff to maintain and adjust it; in other cases (e.g., code control posts in sorting centres) less knowledge was required. Nevertheless, even the crossover to less skilled tasks called for a certain initial training. The efforts made in retraining were more likely to prove successful if workers enjoyed a broad and diversified basic education or vocational training.

In a previously cited study, Peitchinis (1980) refers to an examination of the employment effects of computer-aided design systems in a number of establishments in West Germany. The examination found that handicraft-oriented and precision-mechanic types of work functions are devalued, while work functions related to computer programming, computer input, and the interpretation, valuation, modification and adjustment to computer outputs are revalued. Evidence further suggested that the educational and technical standards of the occupations involved were sufficiently high for successful adjustment to the new work functions to proceed.

In summary, there is no consistent or convincing evidence that technological change has consistently imposed higher educational requirements or requirements for increased technical training on workers or managers. Most of the available evidence tends to parallel Hiestand's (1974) findings for the steel industry; namely, that technological change takes place with relatively minor or no explicit concerns about manpower. In the case of the steel industry, Hiestand found that the adoption of a new process is often spread over four to eight years. During this time, almost any particular skill or capacity that might be needed can be developed or acquired by the existing staff of the company.

Hiestand holds that the steel industry experience may not be typical because none of the technological changes impacting on the industry in the past 20 years represented a major innovation. The evolutionary nature of technological change allowed senior executives and operating personel to learn to cope effectively with new technology. He suggests that a new, dynamic technology in a rapidly growing industry will confront more difficulties on the manpower front. This view may be especially relevant in recent years according to observers who argue that the skill and educational requirements of the microelectronics "revolution" are substantially different from preceding generations of technological change.

The Recent Evidence

The argument that historical relationships between formal education and changing skill demands are poor guides to current and future experience leads to the contention that the growth of employment in jobs requiring high levels of education is related not to the particular state of technology at the time, but to its rate of change. Specifically, more highly trained and educated people may be needed to change the design of products, processes and organizations in an environment of rapidly changing technology. Peitchinis (1978, p. 23), for one, suggests that the relevant link between required skill changes and formal educational attainments will become more pronounced in the future, in part because of a more rapid and discontinuous rate of technological change.

Unfortunately, evidence to date is far too fragmentary to permit a definitive evaluation of the claim that, insofar as the relationship between required skill changes and formal education is concerned, the past is not a prologue. Contrary to this claim, it is at least suggestive that the skill-change impact of recent technological change does not seem inconsistent with historical patterns. It is also suggestive that, while managers responding to Peitchinis's (1978, p. 23) survey noted that 60 percent of employees will require an increase in technical knowledge (as opposed to only 18 percent in the recent past), the evidence from major recent innovations, such as robotics, indicates that much of the anticipated retraining of existing workers can take place fairly readily within a company.[17]

While it is true that the introduction of robotics in particular appears to be emphasizing a need for greater numbers of engineers, the magnitude and duration of this need is uncertain. Furthermore, it is not unusual for shortages of certain types of engineering skills to become temporary bottlenecks to the early diffusion of innovations. For example, Globerman (1984) found that a shortage of systems engineers and programmers discouraged the spread of electronic data processing (EDP) adoption by insurance companies in the early stages of computerization. The observation that a scarcity of specific skills can become a bottleneck to technological change argues for flexibility and responsiveness in our educational institutions, both formal and on the job. Whether it argues for a significant commitment of additional resources to expand long-run enrolment in schools of engineering is another question. On the basis of available evidence, we are not prepared to argue whether or not the percentage of engineers in Canada's work force should be increased to stimulate the faster spread of new technology. We are prepared to argue, admittedly on the basis of fairly weak inference, that the evidence in support of such action is not necessarily more compelling in recent periods than in decades past.

In summary, the evidence to this point suggests that technological

change alters the supply/demand balance for different occupational skills, and that the alteration "necessitates" adjustments in terms of available skills in the work force. Such adjustments, however, do not appear to upgrade formal education levels sharply. We hasten to note that these findings cannot be taken to mean that devoting additional real resources to formal education would not be a "paying investment." Nor does the available evidence suggest that formal education is irrelevant to the adaptability of the work force. Indeed, findings that workers with good "generic" skills absorb on-the-job training more readily than those without implies the opposite. Nevertheless, the benefits of formal education, in terms of the adaptability of the work force, do not seem to be more compelling, given current patterns of technological change, than in the past.

Educational Background and Technological Performance

The two preceding major sections of this paper examined indirect evidence bearing on the relationship between education and the adaptability of the work force to technological change. In this section we consider some additional indirect evidence: namely, are the educational characteristics of workers and/or managers in organizations linked to the rate at which organizations adopt new technology, other factors being constant?

In principle, there should be a relationship between the education levels of workers and managers and the rates at which their organizations adopt new technology. Since "more adaptable" workers and managers would ostensibly suffer lower costs in adjusting to technological change,[18] they would presumably impose fewer obstacles to the adoption of technological change within the organizations they worked for. If more educated workers are more adaptable than their less educated counterparts, we would expect to observe a positive relationship between education levels in organizations and the technological progressivity of those organizations. Conversely, organizations with less educated workers and managers might find themselves at a competitive disadvantage vis-à-vis their rivals; hence, they might be under greater pressure to adopt new technology than firms with more educated employees.

In fact, most economic studies of technological diffusion incorporate the profitability of innovation adoption as an explicit variable in the relevant statistical models. To the extent that these studies also include measures of education as independent variables in their models, we would expect firms managed by more highly educated personnel to be faster in adopting innovations, given that the influence of profitability is held constant in a multivariate framework.

Notwithstanding the existence of a substantial literature on patterns

and determinants of new technology adoption, relatively few studies have explicitly considered the link (if any) between the rate at which an organization adopts innovations and the educational background of its employees and managers. Moreover, those studies that have evaluated the latter relationship tend to be inconclusive. While a few available studies provide direct evidence that more educated managers are quicker to adopt new technology than their less educated counterparts, a substantial proportion provide only indirect support for the adaptability hypothesis, or (in fact) no support at all.

Evidence for the Agricultural Sector

Some indirect evidence supporting the adaptability hypothesis is provided by Welch's (1970) finding that college-educated farmers were more productive than their less educated counterparts, which he attributes to their greater ability to take advantage of new technology. In a more direct investigation, Jamison and Moock (1984) used data from Nepal to ascertain the relationship between education, farmer efficiency and farmers' attitudes toward technological innovation. They found that for both educational attainment and for numeracy — that is, scores on numeracy tests — there are relatively weak effects on productivity for familiar, traditional crops. For the recently introduced wheat crop, however, significant productivity effects are evident. Furthermore, there appears to be a distinct threshold related to school attainment. Farmers who had completed one to six years of school were no more productive than farmers who had never been to school, but farmers who had completed seven or more years of school were significantly more productive than those who had completed fewer than seven. Interestingly, there is no relationship between education and a farmer's decision to grow wheat; however, having attended school is related to the adoption of chemical fertilizer.

Evidence for the Industrial Sector

Most economic studies of technological diffusion have focussed on industrial innovations. In one major study, Mansfield et al. (1977) looked at the adoption of numerically controlled machine tools in ten U.S. industries. In one version of the model, the dependent variable was the probability of a firm using numerically controlled (NC) machine tools as of a specific date. They found that an increase of 10 percent in the years of schooling of the company's president, all other things being equal, resulted in a .02 percent increase in the probability of NC use. However, in another model, the dependent variable was the length of time a firm waited before adopting NC machine tools. For this specification of the dependent variable, the average education level for all managers

involved in the adoption process was not significantly related to the dependent variable. In a third model, the dependent variable was the number of years between the time when 10 percent of all machine tool purchases were NC to when 40 percent were NC. The education variable was again statistically insignificant.

In a study closely paralleling Mansfield's, Globerman (1975) examined the determinants of adoption of NC machine tools in a random sample of Canadian tool and die firms. He found that companies headed by older company presidents were more likely to be early NC users, while the education level of the company president was unrelated to the likelihood of a company being an early NC user. He interprets this result as evidence that "experiential" learning may be more important to assessing new technology than formal education.

Some indirect support for the adaptability hypothesis is suggested by Metcalfe's (1970) finding that larger and more vertically integrated textile firms made greatest use of new textile machinery. He ascribes this to the likelihood that larger firms are better able to attract qualified scientists and technologists. While Metcalfe's interpretation of the evidence may be valid, it should be pointed out that other studies that find a positive relationship between firm size and speed of innovation adoption credit it to the fact that new technology often cannot be installed piecemeal and thus is most advantageous to large firms.

In contrast, in his study of the U.S. steel industry, Hiestand (1974) concludes that there does not seem to be any relationship between the quality of a company's high-level manpower and the timing of its decision to install a new technology. He speculates that the primary contribution by a company's managerial and professional manpower is not so much in the timing or nature of capital investment as in how well facilities are utilized once they are installed. Hiestand's basic argument receives some support in Gold's (1978) assessment of the Japanese steel industry. Gold argues that the Japanese have surpassed the United States and all other Western countries in the computerization of most steel operations, and that no contribution to the development and application of computerization in the Japanese steel industry was more important than the strong and unwavering support of top management. This support was rooted not in the education of Japanese managers but in basic elements of Japanese managerial philosophy, including a commitment to international excellence.

It is impractical to review all the various technological studies that fail to consider explicitly the influence of management and worker educational backgrounds; however, it might be noted in passing that a number of quantitative studies are able to explain a large percentage of the variation across firms in adoption behaviour without including educational characteristics of the work force in the relevant models. One such study is Romeo's (1977) examination of the adoption of numerically controlled machine tools in ten different industries.

Other Relevant Evidence

The economics literature focussing on technological diffusion can be criticized for an undue emphasis on manufacturing industries to the neglect of service industries. This general criticism might, in fact, be made about most literature on technological change. In large measure, this focus reflects the fact that manufacturing innovations have been clearly identifiable while, until recently, service sector innovations tended to be organizational and hence not easily identified. To this extent, the limited support provided for the adaptability hypothesis might reflect the relatively restricted industrial scope of available studies. In this regard, however, Globerman (1981) found that the automation of a Canadian university library by 1972, as well as the number of automated library activities, was not significantly related to the ratio of professional librarians to total full-time equivalent staff.

The diffusion literature might also be criticized for its preoccupation with the adoption of new industrial equipment as a measure of technological progressivity. We might argue that other dimensions of corporate flexibility should be examined, including the introduction of organizational changes, the use of new marketing techniques, and so forth. The available evidence here is quite thin, indeed. In one somewhat relevant study, Poole et al. (1982) examined the attitudes of British managers toward industrial relations practices in a wide range of public and private sector activities. They found no significant relationship between attitudes and educational background. This supports one hypothesis that highly educated managers are no more likely to be utilizing "new and improved" labour relations practices than their less educated counterparts; however, this inference must be tempered by the authors' finding that attitudes are often unrelated to actual behaviour.

More anecdotal, but nevertheless suggestive, evidence on the relationship between managerial progressivity and the background of managers is provided by assessments of "excellent" companies. This literature is largely encompassed within the business policy stream of research. Since case studies form the primary basis for the empirical work in this genre, it is difficult to ascribe levels of confidence to the reported findings. Nevertheless, the well-known study in this area by Peters and Waterman (1984) fails to identify educational attainment as a significant attribute of managers who have successfully kept their companies ahead of the competitive pack. Moreover, studies of entrepreneurship, reviewed by Gilad (1982), fail to identify entrepreneurs as enjoying above average levels of education.

There is no consensus of opinion among practitioners that successful managers require a highly "technical" educational background. If anything, there is a growing view that corporate leaders should have a much better grounding in the humanities and social sciences than they do. Kenny (1984) reports AT&T chairman Charles Brown's recent description

of an AT&T longitudinal study which traced the careers of corporate employees for 27 years. The study showed that humanities and social science majors achieved the best overall performance and demonstrated strong interpersonal skills. They were similar to business majors in administrative abililty and motivations for advancement and, in Brown's words, they were most suited for change. In a related vein, Behrman and Levin (1984) report that critics of business schools, including corporate officers, assert that schools place too much emphasis on quantitative analysis and too little on qualitative factors that arise from corporate goal setting.

We do not mean to imply that the economic performance of a nation will be unaffected by the scientific and engineering background of its professional work force. Observers acknowledge that perpetuating the advance of a technology that rests on a well-developed scientific base requires a steady influx of highly trained research scientists and engineers. For example, according to Levin (1982), scientists and electrical engineers entering the semiconductor industry have always needed a substantial dose of on-the-job training, but formal higher education to the bachelor's level, and for many jobs beyond, is an indispensable prerequisite. Furthermore, Subramanian and Ganeson (1981), among others, have found that more highly educated and more experienced scientists are responsible for relatively more innovations than their less highly educated, less experienced colleagues.

In addition, as noted in an earlier section, shortages of engineering and related technical skills can be bottlenecks to the adoption of innovations in the early stages of the diffusion process. But notwithstanding these disclaimers, most economic historians, including Rosenberg (1982), conclude that a high degree of scientific originality and a top-quality scientific establishment have been neither a necessary nor a sufficient condition for technological dynamism. Hence, it seems fair to conclude that an increase in engineering background in the work force would, on the margin, speed up the rate of diffusion of innovations. Whether the resulting benefits would justify a commitment to increase significantly the number of engineers Canada graduates each year is unclear.

Conclusions and Policy Implications

Our purpose in this paper was to review and synthesize available evidence bearing on the relationships between the quantity of education, educational curricula, and the adaptability of workers and managers to technological change. The available evidence is largely indirect, and therefore admits only broad qualitative evaluations. Nevertheless, there seems to be sufficient consistency in the literature to support a number of conclusions.

One such conclusion is that unless future experience differs markedly from the past, the forecasts of some technological gurus for a massive "upgrading" in required skills in the work force, or even for a sharp divergence from existing broad patterns of skill demand, are likely to prove highly exaggerated. While the evidence on the skill-related impact of the "microprocessor revolution" is still fairly limited, it does not suggest that recent experience is fundamentally different from experience over the preceding postwar period. That is, non-neutral impact on occupational skills apparently exists, but the skill adjustments required to avoid widespread displacement of existing workers and managers are relatively modest. While we can only speculate about the future, there is no compelling reason to believe that the future pattern of the technology-skill relationship will differ markedly from the pattern up to now.

A second, and perhaps more controversial, conclusion is that even if future technological change alters the distribution of skill demands in the economy much more markedly than in the past, it does not necessarily follow that significant increases in the quantity of formal education "supplied," or significant changes to current curricula — for example, more science and engineering courses in secondary and post-secondary schools — are appropriate policy responses. Research shows that the overwhelming majority of workers learn specific employment skills primarily on the job, rather than in formal educational programs.[19] This appears to be true even for professional occupations such as management. A summary of a recent survey of thirteen corporate executives in Canada is revealing in this respect. The executives reported that their companies were looking for more adaptable employees, who were more willing to take risks and who better understood the business and its problems. At least one-third of the respondents indicated that little was new in their employment objectives, and most did not even suggest that increased formal education was a route toward achieving the goal of "higher quality" employees.[20]

None of the foregoing observations can be construed as evidence that formal education is unrelated to performance in the workplace. Indeed, countless studies document that more highly educated workers enjoy higher lifetime incomes than their less educated counterparts. As well, evidence that returns to education seem not to have declined significantly (until recently), notwithstanding sharp increases in the supply of educated people, would seem to suggest that the demand for educated individuals in the workplace has increased substantially, perhaps as a consequence of technological change. If so, it might belie our contention that technological change has not imposed consistently greater demands for skill upgrading through intensified formal education.

While it is beyond the scope of this paper to review explanations for the relative constancy over time in rates of return to investments in human capital, it suffices to note that existing studies have great diffi-

culty in identifying to what extent degrees pay off because of "credentialization" and to what extent education pays off because it contributes to a person's ability to perform.[21] Of course, to the extent that attained education serves as an efficient screening tool for employers, formal education may still provide an important public goods-type service. A related service would be provided to the extent that education socializes workers so that they are more amenable to following directions in hierarchical organizations, a hypothesis supported in a relatively recent study by DiMaggio (1982).

It must also be acknowledged that the major contribution of formal education to enhancing the adaptability of the work force to technological change may be that it equips individuals to learn efficiently while on the job.[22] Indeed, this contribution may go unrecognized by individuals who indicate that there is little formal education directly used in their current employment, which would be consistent with evidence cited earlier in the paper.

It is also consistent with a view that core skills are imparted through the general education process and that these skills are fungible over a wide range of occupations. This view is further supported in findings cited in Hunter and Schmidt (1982) that, with respect to specific skills, both general cognitive ability and general psychomotor ability are valid for all jobs, though the validity of either ability varies as a function of job complexity. Specifically, the relevance of general cognitive ability increases as job complexity increases, while the opposite is true for general psychomotor ability. Smith (1981, p. 15) makes a related argument that there is a core set of generic skills that are transferable across a variety of technical occupations. They include mathematical, communication, interpersonal, reasoning and manipulative skills.

On the basis of the evidence reviewed, there is no way we can argue that either too much or too little is being spent in Canada on formal education. Nor is the evidence precise enough to suggest that significant changes should be made to curricula so as to emphasize, say, mathematics relative to communications skills, let alone to suggest what specific courses might be added to or dropped from curricula. Nevertheless, it would appear that the generalist position, as outlined in an earlier section, is broadly appropriate. Beyond the evidence adduced to this point, Jencks (1979) reports findings that a respondent's performance on tests of vocabulary, reading comprehension, mathematics, English, abstract reasoning and creativity predict future patterns of education, occupation and earnings better than do any other tests or composites of personal attributes. Perhaps even more supportive of the generalist argument are Jencks's (p. 97) observations that tests given after the sixth grade predict future educational attainment no better than sixth-grade tests, and that test scores in the third grade also appear to predict an individual's occupational status about as well as tests given

later in school. Thus, if formal education is explicitly seen by policy makers as an activity designed to mitigate the skill-displacement effects of technological change, it would seem that particular attention should be directed at the "quality" of basic education provided in primary and (perhaps) secondary schools.

Notes

This study was completed in September 1984.

1. Comprehensive reviews of the productivity literature tend to conclude that the sharp declines in productivity growth experienced in the post-1973 period had multiple causes, and there is no evidence that a declining quality of education was a prominent factor. For one such review see Sharpe (1982).
2. A classic illustration of such complementarity is the tremendous demand for programmers and systems engineers created by the rapid diffusion of computer use in the 1960s and 1970s.
3. For example, the Canadian Machine Builders' Association, in a submission to the Royal Commission, stressed that increased training be offered for the following occupations: professional manufacturing engineers, skilled machinists and toolmakers, qualified numerical control programmers, software engineers, and electronic technicians.
4. This restricted focus reflects both pragmatic limitations in the scope of our investigation, as well as the fact that other research studies undertaken for this Royal Commission consider vocational education and training programs.
5. A perceived underfunding of universities has come in for particular criticism. See Ronald Anderson, "Shortchanging Universities Threatens Brainpower Gap," *Globe and Mail*, June 18, 1984, p. B2.
6. David Vice, president of Northern Telecom of Canada, was recently quoted as saying: "It is not only scientists and engineers who are in short supply; there also are too few technologically trained people in management, marketing, service and production." See Anderson, "Shortchanging Universities."
7. See Roger Newman, "Computer Scientists Could Become Scarce," *Globe and Mail*, May 13, 1983, p. B21.
8. See Robert Matas, "Schools Turning Out Too Many Specialists, NRC President Says," *Globe and Mail*, April 20, 1983, p. 8.
9. Since the framework being described here is for heuristic purposes and not for empirical implementation, we will not be concerned with defining the elements of the matrix with greater precision.
10. An early and seminal contribution in this area is found in Scoville (1969). A more recent discussion of the relevant issues can be found in Rosen (1978, pp. 235–50). A brief but quite up-to-date bibliography of different approaches to implementing the concept of skill in labour market studies is provided in Newton (1984).
11. For an extensive discussion of the nexus between job design and organizational choice see Newton (1984).
12. An important policy-related question falling outside the scope of this study is whether managers make efficient tradeoffs between substituting new workers for existing workers (either through retraining or hires and fires) and redesigning the tasks required of workers. For example, employing "user-friendly" software makes it more likely that a typist not trained in data processing/computer science can perform word processing and data-base management functions; however, if the job is implicitly defined as one involving systems analysis and programming — for example, internal development and implementation of word processing and data-base packages — conventional typing skills will be highly inappropriate to the task.
13. We are deliberately ignoring the issue of whether skills are separable in any given occupation, as well as whether specific skills can be aggregated across workers.

14. In effect, we are focussing on the "mismatching" of skill supply and demand related to the diffusion of new technology rather than on overall surpluses of labour created by introducing capital-augmenting technology. For further discussion see Allen (1985).
15. It could be argued, of course, that (historically) formal education has had broader and less tangible objectives. Nevertheless, if it were found that other market mechanisms emerge to "clear" the market for skills efficiently, the potential education adaptability nexus would lose much of its policy relevance.
16. See Lawrence Surtees, "Workers Are Warily Adapting to Robotics on Assembly Lines," *Globe and Mail*, March 16, 1984, p. B4.
17. Robert Ayers of Carnegie-Mellon University predicts that "in the next decade, most robot technicians will be recycled workers previously working in the same production area where the robots are now working." See Faulkes and Hirsch (1984, pp. 94–102).
18. Such costs might encompass an increased risk of unemployment, the need to undertake extensive retraining and so forth.
19. We again emphasize that vocational training programs in community colleges and the like are not necessarily included in this assessment. There is, of course, substantial debate about the transferability of technical skills acquired in these programs directly to the workplace. See, for example, Weiermair (1983).
20. See Robert Taylor, "Study Shows Firms Seek Higher-Quality Workers," *Globe and Mail*, June 26, 1984, p. B4.
21. See, for example, Allen (1985).
22. There is also evidence that more highly educated individuals are faster adopters of new household products. While this evidence has interesting implications for a relationship between formal education and efficiency in consumption, it is somewhat beyond the scope of this report. For a recent study and references to the literature the reader might consult Sawyer (1982, pp. 201–11).

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The Impact of Technical Change on Employment, Wages, and the Distribution of Skills: *A Historical Perspective*

ROBERT C. ALLEN

Today, many people believe we are about to enter a new technological age based on microelectronics and robotics. These developments hold out such a great possibility for higher labour productivity that there is concern that they will lead to widespread unemployment. Lower wages would follow as the unemployed compete for the remaining jobs. Moreover, it is feared that these new technologies will increase skill inequality by eliminating many skilled and semiskilled jobs while creating a small number of highly skilled jobs and a mass of unskilled assembly and operative jobs.

Ours is not the first age in which technical change has remade society and today is not the first era in which people have feared that technological developments will cause widespread social distress. In this essay we will briefly review some of the hopes and fears entertained about technical change since 1800 and then examine historical evidence to assess what the impact of technical change actually has been. The future is not a simple extrapolation of the past, however, so much of the discussion is devoted to analyzing why technical change had the effects it did. That analysis will help us anticipate the future and develop policies to realize the benefits of technical change while avoiding or minimizing the costs.

Past Views on Technological Change

Whenever unemployment has been a persistent problem, some people have wondered whether technological change was a contributing cause. There have thus been three debates on the consequences of technological change. The first was in England during the Industrial Revolu-

tion, the second in the 1920s and the Great Depression of the 1930s, and the third the automation debate of the 1950s and 1960s.

Four important issues were usually discussed, although the emphasis given to each varied. These issues are the same as those that concern us today: the effect of technical change on economic growth, employment, real wages, and the distribution of skills. I will review the opinions entertained on these issues during the Industrial Revolution, for it was surely the most far-reaching technological event, and the automation debate, because its concerns were similar to those today. We will take the issues in turn. What is impressive is the way the tone of the debate has shifted from pessimism to optimism.

Economic Growth

The only issue on which everyone, whether classicist or modernist, defender of capitalism or its critic, agrees is the relationship between technical progress and economic growth — that is, the long-term rise in per capita income. It is generally accepted that technical progress has been the main cause of economic growth. About all else there is controversy.

Employment

Most reputable economists have maintained that technical change need not cause mass unemployment. That position was middle-class dogma during the British Industrial Revolution of the late 18th and early 19th centuries (Berg, 1980, p. 721). Two lines of argument supported this view. First, the classical economists denied that there could be persistent involuntary unemployment for any reason so long as wages were downwardly flexible. Under that condition, technical change might temporarily put people out of work, but they would eventually be able to find employment as the wage fell. Second, technical change lowered costs, which allowed an expansion of production into foreign markets. The decline in labour per unit of output would be more than matched by a rise in total production (Berg, 1980, pp. 107–08). Ricardo accepted this position in arguing against legal restrictions on the use of machinery. If Britain "gave up the system that enabled [it] to undersell in the foreign market, would other nations refrain from pursuing it? Certainly not" (Berg, 1980, pp. 101–02). They would get the employment created by the new machines and Britain would get the unemployment that resulted in the hand trades.

Although it was the conventional view in the British Industrial Revolution that technical change did not cause unemployment, there were many dissenters. They could look to two of the greatest classical economists, Ricardo and Marx, for intellectual support. When Ricardo added

his famous machinery chapter to the third edition of his *Principles* in 1821, he attacked the conventional view. "The opinion entertained by the labouring class, that the employment of machinery is frequently detrimental to their interests, is not founded on prejudice and error, but is conformable to the correct principles of political economy" (as quoted in Berg, 1980, p. 72). He did not, however, advocate preventing technical change.

Marx was the last great classical economist, and he also believed technical change created large-scale unemployment and, thereby, contributed to the "reserve army of the unemployed." "The labourers, when driven out of the workshop by the machinery, are thrown upon the labour market, and there add to the number of workmen at the disposal of the capitalists" (Marx, 1906, p. 481). Because capitalism encourages technical progress, it tends to create technological unemployment.

During the automation debate of the 1950s and 1960s most economists argued that automation would not cause unemployment. Nobel-laureate Herbert Simon (1962, p. 235–36) offered a classical argument for that position: "As technology changes and machines become more productive, the prices of labor and capital will so adjust themselves as to clear the market of both." So long as wage rates are flexible, technical change will not produce long-term unemployment. Even if wage rates were rigid, most economists believed that unemployment could be eliminated with appropriate macroeconomic policies. Thus Mansfield (1971, p. 106) wrote: "Rapid technological change need not result in increased aggregate unemployment. The important thing is that the government increase aggregate demand at the proper rate."

The international competitiveness argument that impressed Ricardo has also been used to argue that automation creates employment: "On the international front, we recognize that we need the production efficiencies that automation allows us if we are to compete effectively in the free world markets" (Dubold, 1962, p. 51).

Real Wages

No one in the early 19th century entertained much hope that technical progress would raise wages. For pessimists on the employment question, such as Marx, it was easy to argue that wages would remain at the subsistence level. Technical change generated mass unemployment. Competition for jobs among the employed and the unemployed meant that wages would never rise. For optimists on the employment question, Malthusian population theory led to the same result. Any rise in wages above subsistence would lead to a rise in the rate of population growth that eventually would drive wages back to the subsistence level. The only hope for a rise in wages was that mechanization would lead to new skills (e.g., machinery makers) and that these skills would command

high wages as compensation for the training needed to acquire them. At best, this would raise some people's wages, but it was not expected to be a solution to working-class poverty.

Views had changed radically by the time of the automation debate. The notion that technical change stifled the rise of real wages was generally rejected. Indeed, academic economists endorsed the opposite conclusion: "labour-augmenting technical change" was the basis for the secular rise in real wages (Solow, 1970).

Skills

Most observers of social change in the early 19th century believed that mechanization increased skill inequalities. The Industrial Revolution had certainly created some new skills, particularly in the engineering industry. "The 'mechanic' . . . was a new type of workman evolved by the methods of industry itself" (Berg, 1980, p. 152). These technicians were somewhat less skilled than their predecessors, the millwrights of the 18th century, but they were much more numerous and organized themselves into a hierarchy of trades and professions (Berg, 1980, pp. 152–61). In contrast, most of the new jobs of the Industrial Revolution appeared to contemporaries to require no skill. Many jobs were done by untrained women and children. "Just as the savage was regarded as a relic, so now was the ingenious artisan. John Rae traced with regret the transformation of the artisan into a 'mere operative'" (Berg, 1980, p. 143). Adam Smith (1937) and Charles Babbage (1835) advance theoretical accounts of this transformation. We will consider their arguments in a later section.

Precisely the opposite opinion was widely held during the automation debate. Those who claimed that automation caused the rise in unemployment in the late 1950s and early 1960s argued that the new technology increased the demand for educated labour while reducing the demand for uneducated labour (Lipsey, 1965). Thus, Arthur Goldberg (1962, p. 7), the U.S. Secretary of Labor, claimed that "Automation, for example, upgrades the entire labor force by requiring higher educational and occupational attainments. It sets a bright new premium on skill and intelligence." This view was common among social scientists but not all accepted the corollary that automation was responsible for the rise in the unemployment rate (Bell, 1976; Kerr et al., 1960).

Summary

This review of opinions on the impact of technology reveals several things. First, all observers of social change have concluded that technical change is a major cause of economic growth, and that will no doubt continue to be true. Second, there has been considerable disagreement

as to whether technical change benefits everyone. Third, there has been a dramatic shift in the last century and a half from a pessimistic to an optimistic assessment of technical change. The next section discusses the evidence that has led to that shift in opinion.

Aggregate Considerations

Many kinds of arguments and historical evidence can be used to assess the views reported in the previous section. In this section we will examine aggregate evidence — in particular, per capita income, unemployment rates, and real wages — to test the views about the effect of technical change on these variables. The evidence supports an optimistic assessment of the long-run effects of technical change. We will also consider general equilibrium arguments that are usually taken to support an optimistic assessment.

Per Capita Income

Since the mid-18th century, real per capita income has been rising in the developed world (Kuznets, 1972, pp. 38–40) and technical change has been occurring simultaneously. This conjunction is consistent with the usual claim that technical change is a major cause of economic growth. In the past four decades, economists have developed procedures to measure more precisely the contribution of technical progress to economic growth. These measurements confirm the importance of technical progress.

Serious attempts using aggregate data to measure the contribution of technical change to economic growth began about 1950. These efforts at measurement are usually called exercises in "growth accounting" because their aim is to partition the growth rate of real output into its "sources" and thus "account for" the growth. According to the economist's definition, a technical improvement occurs if it is subsequently possible to produce more output from a given bundle of inputs or if the same output can be produced with lesser quantities of some or all of the inputs. The important thing is to consider all of the inputs and outputs. Thus, a rise in labour productivity caused by a rise in capital per worker would not be technical change. One would say that technical change had occurred only if the rise in output per worker exceeded what one would expect in view of any accompanying rise in capital per worker.

Schmookler's (1952) and Abromovitz's (1956) studies were the first attempts to see whether the rise in real American GNP since 1869 could be attributed to the increase in labour, capital and land in the American economy. They found that output grew more rapidly than would be expected in view of the growth of inputs and so concluded that technical change was an important cause of growth. Solow (1957) gave an elegant

theoretical basis for these sorts of calculations. He derived what has become the basic growth accounting identity:

$$\text{rate of technical progress} = \text{rate of growth of real output} - \underbrace{\left(\text{share of labour} \times \text{rate of growth of labour} + \text{share of capital} \times \text{rate of growth of capital} + \text{share of land} \times \text{rate of growth of land}\right)}_{\text{rate of growth of inputs}}$$

The shares are the shares of national income accruing to the various factors of production.

In this identity the rate of growth of inputs shows how rapidly we would expect output to grow in the absence of technical change. The difference between that expected rate and the actual rate is called the "residual" and is taken to be the rate of technical progress by economists. In Solow's application of the identity, 87.5 percent of the growth in output per worker in the private nonfarm sector of the U.S. economy from 1909 to 1949 was due to residual productivity growth and only 12.5 percent was attributable to more capital per worker. This result supports the view that technical progress has been a main cause of rising living standards in the developed world.

Because the growth accounting identity measures the rate of productivity growth as a residual, it is distorted by errors in the measurement of inputs and output. Moreover, it is not enlightening to be told that most of the growth in GNP is due to unmeasured and unknown factors outside the model. Economists quickly confronted both problems. The path-breaking study was Denison's (1962) examination of American growth between 1909 and 1957. Although he introduced several new procedures, his main innovation in this regard was to measure labour in "quality units" that took account of the increase in the education of the work force and the presumed greater productivity of more educated workers. (See the section about the distribution of skills for a discussion of the reasoning underlying this presumption.) The labour force measured in quality units grew more rapidly than when measured in the "natural units" (i.e., total hours worked) that Solow used. A higher rate of growth of labour means a lower growth rate for the residual according to the growth-accounting identity. The reduction in the residual measures the contribution of education to economic growth. The smaller residual implies a smaller role for technical change as a source of growth. Many studies have elaborated these procedures for the U.S. economy and applied them to other advanced economies. Although Denison showed that the contribution of technical change to the rise in the American GNP since 1909 is smaller than Solow's calculation suggested, it is still substantial. Lithwick (1970) provides detailed evidence for Canada.

Denison's refinements have buttressed the overall conclusion that technical progress has been an important source of economic growth.

Unemployment Rates

Estimates of the unemployment rates in Western industrialized countries are available back to about the beginning of this century and, in some countries, earlier, for portions of the labour force. Unemployment rates have risen and fallen over the business cycle, but in spite of enormous structural changes, in particular the decline of agriculture and a remarkable increase in the labour-force participation rate, there has been no long-term rise. In the short term, since 1970, there has been a significant increase in the unemployment rate in most Western countries. Detailed investigations do not find it to be a result of technical change. See Kaliski (1985) for a review of the Canadian evidence.

Real Wages

During the early phases of modern economic growth, per capita income increased but real wages may well have been constant. During the British Industrial Revolution from 1770 to 1820, per capita income increased considerably, in large part owing to technical progress (Floud and McCloskey, 1981, p. 141), with little, if any, increase in real wages (Lindert and Williamson, 1983). The pessimism of the classical economists had a factual base.

Since the early Industrial Revolution, real wages have risen fairly consistently in Great Britain. In other developed countries, they have also been rising for many decades. There is no longer any aggregate evidence to suggest that technical progress has been stifling real wage growth. Real wages and productivity do not rise in perfect unison, however, and it is debatable what causal mechanism connects them. Rees (1959) and Phelps Brown and Browne (1968) discuss the evidence on productivity and real wages. Some theories on the relationship between the two are discussed in the section about the distribution of skills.

General Equilibrium Arguments

In some industries technical change lowers the demand for labour and thereby tends to lower wages or reduce employment. Yet the aggregate evidence shows a long-term increase in real wages and total employment. The apparent inconsistency is usually resolved by appealing to "general equilibrium effects." The claim is that the total effects of a technical change are not confined to the industry in which it occurs. Raising efficiency in the production of one commodity will lower its

price. Two consequences follow. First, the real incomes of all consumers increase. This is the process by which the benefits of technical change (i.e., rising real incomes) are distributed over the community. Second, because the real incomes of consumers rise, the demand for most goods in the economy rises. As a result, the demand for labour in most industries increases. These increases in demand for labour provide job opportunities for the workers initially displaced by the technological change.

Certainly, this is one explanation of a universal rise in levels of consumption. However, we are interested in forecasting the future, not simply understanding the past, so we must ask whether we can rely on the general equilibrium effects to distribute the benefits of technical change equitably in the future. Unfortunately, there is no basis in economic theory for such a hope. Thus, although technological change does allow us to increase the production of some goods without reducing the production of all goods and thus gives us the potential to increase everyone's consumption, general equilibrium models do not guarantee that everyone's consumption will, in fact, rise. General equilibrium models can be constructed in which technological change decreases the equilibrium wage rate. The best reason for expecting that technological change will raise real wages and employment in the future is that technical change has done so in the past.

A Partial Equilibrium Model of Technological Change

The aggregate evidence reviewed in the last section supports an optimistic assessment of the long-run consequences of technical change. Indeed, the shift in opinion between the early 19th century and the 1950s and 1960s was a reflection of favourable economic development during the intervening century. However, the consequences of technical change on the labour force have been more complex and often less pleasant than the overall effect on the economy suggests.

In this section we will consider the effects of technical change on the industry level. This is partial equilibrium analysis, as opposed to general equilibrium analysis which considers the effect on the whole economy. We will consider examples where the welfare of workers is sharply reduced by technical change and examples where worker welfare is increased. Moreover, something can be said about the circumstances that determine whether welfare rises or falls. Before considering examples, it will be useful to develop a theoretical analysis of the effect of technological change.

The model we shall work with is extremely simple, but it illuminates important aspects of technical change.[1] We will discuss a competitive industry producing a single product. This industry also purchases its

inputs in competitive markets. A technical change occurs that cheapens the real cost of production. The question is, What is the impact of that change on employment and wages in this industry? The important lesson of this partial equilibrium model is that there is no general answer to the question. Employment and wages could either rise or fall depending on the nature of the technical change and the characteristics of the input and product markets. The interesting question, then, is what determines the outcome. We will address that question in two stages. First, under what circumstances does technical change decrease labour demand? Second, when does a reduction in labour demand lead to declines in employment and wages?

Labour Demand

Four factors determine whether a technological change will be accompanied by a reduction in labour demand. They are the bias of the change, the price elasticity of demand for the product, the price elasticity of supply of the inputs, and the growth in demand for the product. We will discuss them in turn.

Bias of the Change

Technical change lowers the cost of production by economizing on the use of inputs. In the case of unbiased technical change, the consumption of all inputs is reduced equiproportionately. In biased technical change some inputs are economized on more than others. Indeed, it is possible for the use of some inputs to be increased so long as the increases (in terms of cost) are more than offset by other reductions. Thus there can be no theoretical presumption that technical change will reduce (or increase) labour per unit of output. The impact of the technical change on labour demand will depend (in part) on whether the change uses or saves labour.

Price Elasticity of Product Demand

By lowering cost, technical change lowers the industry's supply curve and causes a product price reduction.[2] The lower price induces an increase in demand for the product. The consequent production increase, in turn, causes an increase in the demand for labour. The more elastic the product demand curve, the larger the increases in production and labour demand.

The bias and the price elasticity effects usually work at cross purposes. Technical change is often labour saving, and that effect tends to reduce labour demand by reducing labour per unit of output. The scale effect works in the opposite direction since lower cost means lower price and more total output. Depending on whether the proportional reduction

in labour per unit of output exceeds or falls short of the proportional increase in the total number of units produced, labour demand could fall or rise.

Price Elasticity of Input Supply

If production exhibits constant returns to scale and if all inputs are available in perfectly elastic supply, then the industry will be a constant cost industry. Price will equal average total cost and both will be independent of output. The product supply curve will be perfectly elastic. In this case, any real cost reductions due to technical change will result in product price reductions of equal amount.

Now consider a case where conditions are the same except that the industry must bid up the wage in order to expand its work force. The labour supply curve, in other words, is not perfectly elastic but increases with the wage. The industry will no longer be a constant cost industry. The supply curve of the product will increase with its price. This example differs in an important way from the constant cost case. Here, a fall in real cost, owing to technical change, is not fully reflected in a decline in product price. The less elastic the labour and thus the product supply curve, the less the product price declines for any given real cost reduction; the less the product price reduction, the less the induced increase in output. The existence of less than perfectly elastic input supply curves attenuates product price reductions and thereby limits the labour demand generating effect of technical change due to elastic product demand.[3]

Growth in Product Demand

Usually product demand is considered to grow independently of the rate of technical change (although we shall shortly consider some models where the separation is not clearcut), and so might be left out of an analysis of its effects. However, the rate of growth of product demand does affect the rate of growth of labour demand and so might offset high rates of labour saving technical change that would otherwise lead to declines in labour demand.

Summary of Labour Demand Determinants

We can distinguish two extreme sets of circumstances. Suppose that technical change was labour saving, that product demand was price inelastic and was not growing. In that case technical change would reduce labour demand. Conversely, suppose technical change was labour intensive, and that product demand was quite elastic. Under these circumstances, even if product demand were static, technical change would increase labour demand. The sign of the labour demand impact of technical change cannot, therefore, be theoretically deter-

mined. The movement of the labour demand curve depends on the facts of the situation.

Labour Market Equilibria

The effect of a decline in labour demand on the work force depends on its alternative employment opportunities. These alternatives determine the elasticity of the labour supply curve and thus whether employment or wages adjust. There are three cases to distinguish. I shall refer to the industry whose labour demand is falling as the declining industry.

Perfectly Elastic Supply of Labour

If the workers in the declining industry have no specialized skills and if they can immediately and at no cost take up employment in an alternative industry at the same wage they are receiving in the declining industry, then the supply of labour to the declining industry is perfectly elastic. In that case, a reduction in labour demand in the declining industry lowers employment in that industry but not wages. No unemployment results, since displaced workers simply shift into other jobs. In this situation, technical change does not adversely affect the work force.

Rising Labour Supply

If the workers in the declining industry differ in the wage they can earn in alternative employment, or if they face differing moving costs, then the supply of labour to the declining industry increases with the wage. This situation might arise if workers differed in their skills and if some skills had valuable alternative uses whereas others did not. In this case, a reduction in labour demand reduces employment and wages concurrently as labour is gradually squeezed out of the industry.

Perfectly Inelastic Labour Supply

If workers in the declining industry have no alternative employment opportunities, then the labour supply is perfectly inelastic. Such a situation might arise for several reasons; for example, the workers' skills are so specialized that they have no alternative employment, or the industry is regionally isolated and there are no alternative opportunities in the same area. In either case, a decline in labour demand does not reduce employment; it lowers wages.

The wage will not fall indefinitely, because it would be pointless to do industrial work for no income. In most societies, unemployment insurance, the welfare system, private charity, or family support provide an income floor above zero. When the wage drops to a comparable level, further declines in labour demand cause unemployment, with the unem-

ployed receiving whatever minimal income their society provides. This labour supply situation is clearly the least favourable for labour.

If the inelasticity of the labour supply is due to regional isolation, emigration is a likely long-run response. If the wage falls so that people can earn more elsewhere, they will have a financial incentive to relocate. This process may take a long time, however.

Implications

The simple model discussed here reveals two important insights into the impact of technological change. First, as previously noted, technological change can either increase or reduce labour demand. Second, the adverse effects of technical change on the work force will be greater the more inelastic the labour supply curve. There are two reasons for this conclusion. An inelastic labour supply curve implies a less elastic product supply curve, which, in turn, lessens the potential employment-creating effect of technical change.[4] Also, a less elastic labour supply curve indicates an immobile labour force which faces wage reductions and potential unemployment (if the wage falls below the social assistance level) from labour demand reductions. This situation is likely to arise in regionally isolated industries. Policies to offset the adverse effects of technical change ought to be developed with this situation squarely in mind.

The Price Elasticity of Demand

The model developed in the last section showed that the labour force consequences of technical change depend on several parameters. In this section we will focus on one of these parameters, the price elasticity of demand for the product. (The next section will be concerned with the bias of technical change.) The model will be expanded to investigate the circumstances under which demand might be sufficiently elastic so that technical change would cause increases in labour demand. Several historically important examples of technical change will be discussed. These examples show technical change that increases and that reduces labour demand. They also illustrate the various labour supply situations discussed in the last section.

The price elasticity of demand for a product will be high if there is a substitute for the product. Historically, there are two situations that result in high price elasticities. First, there is the introduction of a new product that is similar to an old product. A contemporary example is word processing, which produces a similar product to typing. The quantity demanded of each sort of copy is sensitive to the relative price of the two. Therefore, the own price elasticity of demand for each is high; that is, given the price of the other, a small decline in own price causes a large

increase in quantity demanded. Moreover, a small decline in the price for one causes a large decline in the demand curve for the other.

The second situation in which the price elasticity of demand is likely to be large arises because of international competition. If several countries produce the same commodity and compete internationally for business, then each country's sales will be sensitive to its price relative to other countries' prices. The characteristics of demand will then be the same as with typing and word processing.

Technological change in situations like these has unexpected labour demand effects. We will discuss the matter in the context of a new product competing with an old one. It is unusual for the production of the new good to be perfected at its introduction. Consequently, there ensues a high rate of productivity growth in the manufacture of the new good. Its supply curve falls, its price falls, its output increases, and, given the high price elasticity of demand for the new good, the demand for labour in its production also increases. As the price of the new good declines, the demand for the old product is depressed because they are close substitutes. As a result, the price of the old product falls and production and the demand for labour decline. If product demand were sufficiently elastic, total employment in the production of the new and the old good might rise, but a more common situation is one in which the labour demand increase for the new product is less than the decline in the demand for labour in the old. The unexpected feature of this situation is that the high rate of productivity growth is increasing the demand for labour in the manufacturing process where it is occurring. Labour demand reductions are occurring in the manufacturing process not experiencing productivity growth. This process is in the stagnant stage where, depending on the labour supply situation, wage reduction or technological unemployment might occur.

This feature of the model is a result of the products being close substitutes. The same situation can arise in international trade. A high rate of productivity growth can cause employment growth in the country where it occurs and result in unemployment elsewhere in the world if the countries are producing close substitutes.

Let us take as an example the British cotton textile industry during the Industrial Revolution, because it was the first industry to use power-driven machinery and the factory system. These are arguably the most momentous technological developments of the past few centuries. The history of this industry between 1770 and 1850 is a dramatic exhibition of the power of technical change to create and destroy employment and skills.

The production of cotton calicoes using spinning wheels and hand-looms was well established in India in the 17th century. Exportation of cotton cloth to England was extensive until prohibited in 1700 at the

behest of English woollen cloth manufacturers. Some cotton was spun in England in the early 18th century, but it was only used as warp in weaving fustian with a weft of linen. In the middle of the 18th century there were many unsuccessful inventions to improve spinning (Baines, 1835, p. 154). The problem was solved independently with Hargreaves's spinning jenny (1767) and Arkwright's water frame (1769). In the 1770s Crompton invented the mule, which combined features of the spinning jenny and water frame and superseded the jenny. The jenny was installed in people's homes, but the water frame and mule required water or steam power and were used in factories. These machines effected an enormous increase in labour productivity. Eighteenth-century Indian hand spinning required in excess of 50,000 operator hours of labour per 100 pounds of cotton. In 1780 Crompton's mule required 2,000 hours. Perfection of the equipment led to further reduction in labour requirements. In 1825 Robert's automatic mules required 135 operator hours to spin 100 pounds of cotton (Chapman, 1972, p. 20). The effect of these inventions was to generate enormous employment in both cotton spinning and cotton weaving. Table 3-1 presents some pertinent statistics. The increase in output can be gauged by the increase in consumption of raw cotton. All of the employment in cotton spinning mills was the result of the spinning inventions, as was virtually all of the handloom employment. The inventions of the 1760s and 1770s revolutionized only the spinning half of the cotton industry. Weaving was still done by hand and organized in the putting-out system. The expansion of factory spinning thus induced a large increase in weaving employment.

The increase in cotton cloth production did not reduce employment elsewhere in the British economy, in particular in the woollen cloth industry. For several decades after 1790 British consumption of cotton goods did not increase substantially (Edwards, 1967, pp. 26–27). Exports provided the basis for expansion. There was thus some truth to the early 19th-century argument that technical change need not cause unemployment because British industry could expand at the expense of the rest of the world.

Before the 1820s the history of the British cotton textile industry supports an optimistic view about the impact of technical change on the labour force. In that period, employment was expanding. In the late 18th century real wages probably also rose (Wood, 1910, p. 426). After the 1820s the situation changed dramatically. The decisive event was the invention of the power loom. There had been experimentation on power weaving as early as the 1780s (Baines, 1835, pp. 228–35), and it became the standard method in America after 1815 (Zevin, 1971, p. 139), but it was not widely practised in Britain until the 1820s and especially the 1830s. As with spinning, power looms were subject to continuous improvement.

Power looms had two advantages over handlooms. First, they pro-

TABLE 3-1 Statistics of the British Cotton Textile Industry

		Employment				Nominal Wages	
Year	Raw Cotton Consumption	Factory Spinning	Factory (Power) Weaving	Total Factory	Handloom Weaving	Factory Workers	Handloom Weavers
1770	3	—	—	—	—	—	—
1788	20	60	0	60	108	—	—
1801	54	83	0	83	164	—	—
1806	57	90	few	90	184	121	240
1813	78	104	3	107	212	126	180
1817	107	111	10	121	228	125	105
1820	120	115	11	126	240	124	99
1823	154	120	15	135	240	118	99
1824	165	122	45	167	240	118	99
1825	167	124	49	173	240	118	99
1831	263	131	56	187	240	114	72
1832	277	132	64	196	227	114	72
1833	287	133	75	208	213	114	72
1835	318	—	—	220	188	116	75
1839	382	—	—	259	135	112	75
1847	441	—	—	277	53	110	75
1850	588	—	—	331	40	110	75
1856	891	—	—	379	23	126	75
1862	452	—	—	452	3	137	75

Sources: B.R. Mitchell and P. Deane, *Abstract of British Historical Statistics* (Cambridge: Cambridge University Press, 1971), pp. 177–80, and G.H. Wood, "Real Wages and the Standard of Comfort Since 1850," *Journal of the Royal Statistical Society* 72 (1910): 596–99.

Note: Cotton consumption is in millions of pounds, employment is in thousands, and wages are in pence per week.

TABLE 3-2 Real Wages in the British Cotton Industry, 1806–1906

Years	Factory Workers	Handloom Weavers	All Workers
1806–15	76	112	100
1816–25	88	73	78
1826–35	95	66	80
1836–45	94	62	84
1846–55	104	68	99
1856–65	121	66	120
1866–75	146	—	146
1876–85	175	—	175
1886–95	221	—	221
1896–1902	245	—	245

Sources: Wages are from G.H. Wood "Real Wages and the Standard of Comfort Since 1850," *Journal of the Royal Statistical Society* 72 (1910): 598–99; price indices are from P.H. Lindert and J.G. Williamson, "English Workers' Living Standards During the Industrial Revolution: A New Look," *Economic History Review* 36(11) (1983), pp. 1–25; and Wood, "Wages and Comfort."
Note: The table shows average earnings in 1850 pence per week.

duced a more regular cloth. Second, they sharply increased labour productivity. Each handloom required one weaver, but a power-loom weaver operated three to four looms. In addition, twice the cloth was woven on a power loom as on a handloom. Output per worker thus increased about eightfold.

The consequences for workers of the introduction of the power loom were disastrous. As Table 3-1 shows, the initial effect was a sharp fall in handloom weavers' wages. From amongst the highest paid British workers in 1806, they fell to being one of the most miserable groups by the 1830s. Employment then melted away. At the same time, there was an expansion in power-loom employment, but overall, weaving employment fell.

In 1820 handloom weavers were one of the largest occupations in Britain (about 4 percent of the workforce).[5] The decline in their earnings had serious implications for the history of real earnings in the cotton industry. Table 3-2 shows real earnings in 1850 prices. Except for a slight check in 1836–45, the real earnings of factory workers increased continuously, albeit slowly in the first half of the 19th century. The real earnings of handloom weavers, however, fell 41 percent. Most of that fall occurred between 1806–15 and 1816–25. As a result of this decline and the importance of handloom weavers in the cotton industry, the average real earnings of all cotton industry employees averaged less than the 1806–15 level until the decade 1856–65. In the first half of the 19th century output per worker in the British cotton industry increased almost fivefold and real national income per capita almost twofold.[6] During that period, the average worker in the cotton industry, the preeminent industry of the Industrial Revolution, did not share in that general advance.

The history of the cotton textile industry shows that technical progress can be either a boon or a bane to workers. The partial equilibrium model presented earlier helps to explain why. In the late 18th century the spread of factory technology increased the demand for both factory and handloom workers. The demand for their labour increased because improved machinery radically lowered the real price of cotton and cotton was a close substitute for woollens. (The foreign demand curve for British cotton may also have been increasing.) Real wages rose because the supply curve of labour was rising. The increased demand for cotton and the limited supply of hand weavers meant that technical change raised wages and employment in the late 18th century.

This favourable situation ended with the development and perfection of the power loom. The history of weaving in the first half of the 19th century is an example of the competition of a new product (power-woven cloth) with an old product (handwoven cloth). Rapid technical change in power-loom weaving drove down the price of cloth. Between 1815 and 1826 the price of a piece of cloth fell from 18 shillings to 6 shillings (Bythell, 1969, p. 111). Table 3-1 shows that handloom-weaving employment in this period remained static whereas Table 3-2 shows that the real earnings of handloom weavers collapsed. This history is thus an example of labour demand reduction in the presence of an inelastic labour supply. The inelasticity was a result of the rural location of production and the consequent lack of alternative employment. The wage reached (62–66 pence (1850) per week) was extreme destitution. Thereafter, further reductions in demand for handweavers reduced employment but not the wage, as handloom weavers received "poor law" assistance, left their villages or died.

While technical change in power weaving was wreaking catastrophe in the countryside, it was generating employment in the urban factories. Table 3-1 shows that employment for weavers in factories expanded rapidly and reached considerable size. Generally, real wages of factory workers were rising. Since hand- and power-woven cloth were close substitutes, productivity growth in power-loom weaving was employment creating in the power sector and employment destroying in the hand sector.

Examples of this sort are not uncommon. The substitution of iron for wooden ships has had important repercussions in Canada.[7] Moreover, it is an example that involves both new and old products and international competition. In the first half of the 19th century ships were made of wood. Some were made in England but most were made in North America — in ports such as New York and Boston, and in more isolated and specialized centres in Maine and New Brunswick. Iron ships, the new product, were first made on a large scale in the 1850s. Production was located in England because its iron industry was large and low cost. Iron and wooden ships were close substitutes, so their prices moved in

harmony. Initially, iron ships were very expensive, but improvements in their fabrication lowered their price and caused the displacement of wood by iron. Technical change in iron ship-building thus created employment in Britain where a whole new industry emerged. In North America the effect of the fall in the price of iron ships was to lower the demand for wooden ships and with it the demand for ship-building workers. Workers had different experiences, however, depending on their location and alternative employment opportunities. In large cities like New York, where workers could readily shift to other jobs, the supply of labour to the shipyards was elastic. The fall in the demand for ships caused an early end to ship-building as workers quit the industry to take up alternative work at high wages. This is an example of an elastic labour supply situation where employment problems are not severe. In Maine and New Brunswick, however, workers had no such alternative employment. The fall in the demand for ships and labour resulted in wage reductions rather than employment reductions. Only when wages fell to very low levels did ship-building cease and the labour force become unemployed and emigrate or drift into marginal, low-paying work. The situation of these workers was like that of the handloom weavers. Both cases illustrate the implications of an inelastic labour supply.

The model and examples discussed in this section have two implications for a Canadian perspective on the impact of technological change on employment. First, the examples reinforce my earlier conclusion that the problems are likely to be most severe among work forces in isolated areas lacking alternative employment opportunities. Second, many Canadian industries probably face price-elastic demand curves because such a high proportion of Canadian commodity production is either exported or must compete with imports. Consequently, technical change in those industries has great potential to create employment. Indeed, given high rates of technical change in other countries, rapid technical change in Canada may be necessary simply to preserve employment.

Biased Technical Change

We turn now to the subject of biased technical change. There are two reasons for considering this subject. First, as was noted earlier, the bias of a technical change affects whether the change will increase or reduce labour demand. In this regard the issue is analogous to the price elasticity of product demand. Second, the bias of technical change can affect employment through the productivity advantage it can confer on one country engaged in international trade. Thus, new techniques are often peculiarly well adapted to the physical environments and factor price configurations of one trading country. The technique will be less well adapted to the conditions of its competitors and, if used by them, will confer a smaller proportionate cost reduction. The structure of trade and

the international distribution of employment will evidently depend on the rate and bias of technical change.

The Labour-Saving Bias of Technical Change

A new technique that substantially reduces capital and material requirements while modestly increasing labour requirements will be adopted if total costs are reduced; hence, theoretically, technical change aimed at lowering costs does not necessarily lower labour demand. However, history shows that technical change usually reduces labour requirements. It seldom increases them. This characteristic of technical change has been repeatedly noted since the Industrial Revolution (Berg, 1980; Habakkuk, 1962; Hicks, 1932).

The labour-saving bias of technical change has been confirmed by econometric estimation. Most econometric studies confirm the existence of a relative labour-saving bias or relative neutrality (all inputs economized in equal proportion) and either result implies an absolute reduction in labour requirements. Most long-term studies have used American data, either for the manufacturing sector as a whole or disaggregated into the principal industries. Williamson and Lindert (1980, pp. 155–60) survey the studies using aggregate data. The usual result is a strong labour-saving bias to technical change in the 19th and early 20th centuries. Since the 1920s the relative labour-saving bias is less pronounced. (There have been some findings of neutrality.) The result for the 19th century has been confirmed with industry data. Cain and Paterson (1981) found evidence of a relative labour-saving bias to technical change in most American industries between 1850 and 1919. There is strong statistical evidence that technical change usually reduces labour per unit of output.

Why should a labour-saving bias be so pervasive? Economists have made some progress in explaining the phenomenon, but the issue is still open. Hicks (1932) began the modern discussion by suggesting that the labour-saving bias was the result of economic incentives: a rise in the wage rate would lead firms to try to economize on their now more expensive labour. Salter (1960, p. 43) responded that firms are concerned with total cost, not components such as labour cost, so a rise in the wage should not induce a search for labour-saving improvements per se. The literature since then has been concerned with justifying Hicks's intuition in the face of Salter's objection by showing that the logic of cost minimization leads to a bias in technical change toward saving relatively expensive inputs. Such a theory contradicts the argument with which this discussion began: that cost minimization is consistent with either labour-saving or labour-using technical change. Binswanger and Ruttan (1978) summarize the relevant research and extend it. They make it clear that the reasons why technical change reduces demand for labour are still not well understood.

What should we expect in the future? Even if the phenomenon of bias

is not well understood, it has been so common in the past to observe technical change reducing labour per unit of output that it would be foolish not to expect a continuation of that tendency. Even if theorists have not yet adequately modelled inducement mechanisms, there is abundant empirical evidence that the rate, direction and bias of technical change are strongly influenced by economic incentives. In addition to the previously noted econometric studies of bias, which lend support to this view, agricultural economists have assembled compelling evidence for the position (Binswanger and Ruttan, 1978). Moreover, it has long been known that the rate of invention responds to economic incentives (Schmookler, 1954). Given that so many resources are devoted to the purposeful invention of new techniques, it would be surprising if the characteristics of those techniques were uninfluenced by the social, environmental and economic characteristics of the settings in which they were intended to be used.

These considerations teach an important lesson: they disabuse us of an attitude of pessimistic, technological fatalism; that is, of the fear that technology will evolve "on its own" and cause unavoidable social harm. The research on induced innovation shows that technology evolves in response to social and economic incentives and, therefore, is ultimately controllable by society.

Biased Technical Change and International Competition

If inventions are "tailored" to the price structures and physical environments of the countries for which they are intended, then the new technologies will lower costs by a greater percentage in the areas for which they are designed than elsewhere. Biased technical change of this sort shifts world production to the countries that invent technology well suited to their situations. Labour demand rises in those countries and falls in others. This phenomenon has disturbing implications for countries such as Canada that rely to a considerable extent on imported technology.

The history of the plywood industry shows the power of biased technical change.[8] In the 1950s and 1960s there was enormous growth in plywood production in British Columbia and the American Pacific Northwest. This plywood was made from Douglas fir. The bonding process was specific to that species and would not work satisfactorily with other woods, particularly the Loblolly pine grown in the American south. In the early 1960s Georgia-Pacific invented a bonding agent to make southern plywood. More recently other glues have been developed to bond wood chips (particularly aspen) into waferboard which is a close substitute for plywood. Clearly these bonding inventions are biased technical changes. They are of no use to British Columbia producers, but lower production costs in other parts of North America, particularly in the United States.

As the cost of southern plywood has fallen, so has its price. Because it is a close substitute for Douglas fir plywood, production and employment have expanded rapidly in the South since the demand curve for southern plywood is very elastic. At the same time, the fall in the price of southern plywood has forced down the demand curve for British Columbia plywood. The high cost coastal mills have shut down. There is, thus, technological unemployment in British Columbia because of a technological advance in Georgia. The situation cannot be remedied by importing the southern technology because it is biased and will not lower costs in British Columbia.

Examples of this kind raise many issues about Canadian technological policy. First, if technical change is likely to be biased, then the country will probably find itself at a continual disadvantage if it relies on imported technologies. The foreign inventions will never do Canada as much good as they do our competitors who actually invent them. Second, it will generally be in the interest of Canadian firms to invent technologies appropriate to Canadian conditions. Those inventions will raise the value of Canadian resources and confer disproportionate cost advantages on Canadian producers, so it will be profitable for them to expand at the expense of their foreign competitors (Allen, 1983). Third, if whole communities (such as British Columbia's coastal plywood towns) depend on international markets, there may be a case for applying public resources and direction to the invention of technologies appropriate to Canadian conditions. This practice is common in agriculture and might be extended, but the issues are complex and cannot be explored here.

The Elasticity of Input Supplies

In an earlier section we pointed out that the employment-creating effects of technical change are attenuated to the degree that the product supply curve is price inelastic. The less elastic is that curve, the less the induced increase in industry output (and hence labour demand) for any real cost reduction. The product supply curve will be inelastic if the input supply curves are inelastic. To appreciate the significance of this point, it is useful to consider why labour, raw materials, and capital might be in inelastic supply. First, labour will be in inelastic supply if workers lack alternative employment opportunities. That situation will arise if the work force has specialized skills or if it lacks alternative employment owing to regional isolation. Second, raw materials will be in inelastic supply if they are produced from a natural resource subject to a long-term management program. Thus the cut in any year of a forest managed to maximize either sustained yield or the present value of rent will depend little on the value of timber in that year; in other words, the supply curve of timber will be price inelastic. Analogous considerations arise with fish and minerals. Third, capital will be in inelastic supply in

the short run by definition. Suppose that one machine in a plant is changed to save labour in that stage of production while the remaining machines and structures are unaltered. Since most components of the capital stock remain fixed, the supply curve of the mill is price inelastic. Therefore, even though technical change lowers the plant's supply curve, the consequence will be a reduction in employment rather than an expansion of output. When workers fear that technical change will reduce employment in the plants where they work, this is probably the circumstance they fear.

The Distribution of Skills

So far in this study we have considered labour without much reference to skill levels. We will now turn to a discussion of this characteristic. The issue is whether or not technical change has led to an increasing polarization in skills and whether such a trend will continue in the future. We will concentrate on the history of the past century because that is most relevant to the near future.

There are two radically inconsistent views about the evolution of skills in the 20th century. On the one hand, the human capital school contends that almost everyone's skill has increased and denies that much of the work force has been deskilled. On the other hand, radical and Marxist economists assert that most people have been deskilled and that, today, perhaps two-thirds of the work force has effectively no skill. The remaining third, however, are quite skilled, so there has been a considerable increase in skill inequality. We will consider the two positions in turn. In addition to discussing the evidence each school adduces in favour of its position, we will consider the implication of the position for the growth in per capita income, the role of education in economic development, the rise in real wages, and our expectations for the future. Both schools do not address all issues. Where omissions are important they will be noted.

Before discussing the human capital and the radical schools in detail, it should be noted that there is disagreement over the importance of changes in the distribution of skill. Some people think the matter is unimportant, whereas others think it is critical. To set out the positions, suppose that work has, in fact, become less skilled. People who believe that the decline in skilled work is unimportant believe that the market system generates a distribution of job characteristics that maximizes the happiness of the members of society. Some people may value skilled work highly; others may prefer routine work. All people are willing to give up some of their preferred job characteristics for higher wages. Some firms, however, may find there are big cost savings in shifting from a craft to an assembly-line organization. Other firms may find no cost advantage. The labour market mediates these various desires and possibilities. In a competitive equilibrium, the wage adjusts, technologies

are chosen, and people get jobs so that those who prefer routine jobs tend to get them and conversely for those who prefer challenging jobs. The wage rate is such that the marginal worker is indifferent as to the type of job he or she performs: the value to that person of more challenging work just equals the wage premium for skilled work, which just equals the cost saving of the marginal firm's shifting from craft to assembly-line production. This result obtains even if everyone prefers skilled work so long as some prefer it more than others.

There are two reasons why changes in the distribution of skills are of concern. Both can be thought of as responses to the argument just given. The first response is that the above argument is only about the assignment of people to jobs at an instant in time in the face of a defined set of technological possibilities. In the long run, those possibilities are variable as new techniques are invented. Many Marxists (like Braverman whose work will be discussed shortly) believe that the evolution of technology depends on the social relations of production. Inventors in a capitalist economy will tend to invent routinized technologies. The implicit claim is that socialist economies would invent less routinized technologies. As a result, utility could be higher under socialism. For people like Braverman, it is important to show that work has become less skilled to confirm this theory of invention.

The second response to those who think the decline in skills is unimportant is that a person's preferences and expectations about work depend on the quality of work one is performing. As work has become less skilled and more monotonous, workers have reacted by placing less value on stimulating work and more value on material consumption; hence, they have become more willing to trade off skilled work for income. Firms have responded by providing even less interesting jobs. In this case, the preferences that people have at any time are poor guides to their true happiness. Reorganizing work to force people to perform more challenging work than they might initially choose would raise their happiness in the long run as their preferences adjust to the new situation.

The Human Capital School

The human capital school lends no support to the fear that technical change polarizes skill levels, for it contends that everyone's skills have risen in the 20th century. In this formulation, "skill" is equated with "human capital" and investments in human capital include education, health services, on-the-job training, adult education, and migration in response to employment shifts (Schultz, 1971, p. 22). These flows are properly called investments because, to some degree, they involve the deferral of current consumption in return for higher future income. In the case of education, it is clear that the stock of "human capital" has increased dramatically in the 20th century throughout the developed

world. It is claimed that the accumulation of human capital has been responsible for the 20th-century rise in real income and real wages.

Education and Skill

A number of arguments have been offered in support of the claim that there has been a general rise in skills in the 20th century. First, it is frequently said that modern technology is complex and its invention requires skilled scientists and technicians, so modern technology must be increasing skill requirements. The conclusion does not follow from the premise because armies of unskilled operators might be used to operate the modern technology even if a small number of highly trained people were required for its invention. We shall examine that possibility shortly. Second, it is also frequently said that modern technology requires many highly trained repair and maintenance workers, so it increases skill requirements. In fact, as we shall see, that claim is also not true.

A more interesting argument is that the distribution of jobs has moved up the occupational hierarchy during the 20th century. From bottom to top that hierarchy is typically taken to be farmers, blue collar workers (distinguishing labourers, semiskilled operatives, and craftsmen or supervisors), service workers, and office workers (distinguishing clerical from managerial or professional). It is true that the "average" job has moved up this scale. What is questionable is whether the scale has anything to do with skill by any definition. Janitors are above farmers and key punchers above machinists, but those rankings surely do not indicate skill. Rather, occupational scales reflect the middle-class conceit that white-collar work is better than blue-collar work whereas factory work is better than farm work.[9]

The serious argument in favour of a general rise in skills in this century is based on the conjunction of two facts. The first is the secular rise in educational attainment of all segments of the work force. The second is the regularity in all cross-sectional data (like census returns) that income increases with education.

The second fact is significant for two reasons. First, it is common in the human capital literature to assume that product and input markets are competitive and that firms minimize costs. In that case, the wage of each grade of labour equals the value of its marginal product. The positive correlation of pretax wages with education, therefore, indicates that (at the margin) more educated people are more productive than less educated people. Second, education is conceived to be an investment. When someone attends school, the costs are the explicit cost of the teachers, buildings, libraries, and so on, and the relatively low foregone earnings of the student. The compensation is the higher earnings the student receives after completing school.

Human capital theorists do not usually provide explicit definitions of

"skill" other than to equate it with "human capital." These considerations reveal the basis of the equation. A more educated person is said to be more skilled than a less educated person because the marginal productivity of the more educated person is higher and that higher productivity was acquired by investing in schooling. Given the universal rise in educational attainment in the 20th century, it follows that there has been a universal rise in skills. There is no evidence of deskilling.

Education and the Rise in Per Capita Income

The notion of the accumulation of human capital has played an important part in understanding the growth in real output and real per capita income during this century. As discussed in the subsection on per capita income, studies in the 1950s showed that American real GNP had grown much faster than the combined growth of land, labour and capital. (Subsequent studies of other industrialized countries have come to the same conclusion.) In 1961 Nobel-laureate T.W. Schultz (1971, p. 13) proposed that "investment in human capital is probably the major explanation for this difference." His conjecture is incorporated into growth accounting as follows. The studies of the 1950s measured labour by the total number of hours worked. No recognition was given to the fact that an additional hour worked by a highly educated person generated more extra output than an extra hour of uneducated labour. (This statement, of course, assumes that firms minimize costs so that wages indicate marginal products.) By using cross-sectional data to determine the relationship between income (marginal product) and education, we can derive a labour quality index to capture the effect on real output of the 20th-century rise in educational attainment.

In the subsection on per capita income, we explained how measuring labour in quality units reduced the residual and thus the measured importance of technical change to economic growth. The procedure also assigns the reduction in the residual to education as its contribution to growth. Generally this procedure attributes a large share of growth to the rise in educational attainment of the work force.

Education and Rising Real Wages

Human capital theory also provides an explanation for the 20th-century rise in real wages. According to Schultz (1971, pp. 13, 19):

> Investment in human capital accounts for most of the impressive rise in real earnings per worker. . . . Can this [rise] be a windfall? Or, a pure rent reflecting a fixed amount of labor? It seems far more reasonable that it represents rather a return to the investment that has been made in human beings.

This observation is only part of a theory of the rise in real wages. It has been shown empirically that education per worker has risen in the 20th

century. For that increased stock of education to realize a return, the demand for it must also have been growing. Technical progress biased toward using educated labour would generate such a rise in demand. Williamson and Lindert (1980, pp. 156–77) report that many of the fluctuations in the ratio of American skilled to unskilled wages since 1839 can be attributed to fluctuations in the bias of change in aggregate technology. If technical change were not biased toward using educated labour, then the relative wage of educated workers would decline and the incentive for further schooling would cease. In that case, the rise in real wages would also cease.

Classical economists asserted that trades that required considerable training would realize high wages as a return on that investment. The classical economists doubted that capitalist economic growth would generate many such trades. As a result they doubted there would be a general rise in real wages. The human capital theorists accept many of the same premises but believe that technical change has, in fact, increased the demand for educated labour. Educational attainment has risen in response and so have real wages. From the human capital perspective, technical change, a general rise in the level of skill, and a universal rise in living standards have gone together in this century.

Expectations for the Future

Will the future repeat the past? According to the human capital school, there has been a general upgrading of skills and a rise in real wages because it has been profitable to invest in education. This investment has been profitable because technological change has been biased toward using educated labour. Why has technological change had that bias? No one has seriously tried to answer that question. As a result, forecasting is extremely problematic.

The Deskilling School

In contrast to the human capital school, the deskilling school holds that the economic history of the 20th century shows that technical change has increased skill polarization in the work force. The skills of a minority of the work force have increased while the majority have fewer skills today than in former years. The latter have been deskilled. This position is most vigorously argued by Marxists and radicals, but it is also accepted with less enthusiasm by recent corporatist writers in America. What is most important for our expectations of the future, however, is that neither group believes that modern technology necessarily leads to deskilling. Both groups subscribe to an endogeneous theory of technical change and contend that technology developed as it did because skill polarization was in the financial interest of business firms.

To challenge the human capital school successfully, the deskilling school must accomplish four tasks: first, it must provide positive evidence that much of the work force has less skill now than in former years; second, it must rebut the human capital school's analysis of education, for that analysis is the persuasive evidence in favour of the position that there has been a general upgrading of skills; third, it must explain the 20th-century rise in real wages; fourth, it must present a theory to explain why businesses have found it profitable to develop technology that increases skill polarization. We will consider these tasks in turn.

Evidence for Deskilling

An argument that there has been an increase in skill polarization requires a definition of skill. Braverman's *Labour and Monopoly Capital* (1974) is the classic Marxist discussion of these issues and we will follow his development. For Braverman the archetypical skilled worker was the craftsperson (and he explicitly includes farmers in this category). A distinguishing feature of a craftsperson is that he or she unites the functions of conceptualization and execution. The craftsperson must understand the production process, be able to design the product, select the material, organize the work, and also perform the requisite tasks. A long training program (several years or more) is needed for an individual to master all of these abilities. This definition of a skilled person is like the human capital definition in that both make reference to long training. They differ, however, in that the human capital definition says simply that a skilled person has a high marginal product, whereas Braverman's account is far richer and narrower.

Braverman contends that in the past (say around 1800) a high proportion of American workers were skilled. "From earliest times to the Industrial Revolution the craft or skilled trade was the basic unit, the elementary cell of the labour process" (Braverman, 1974, p. 109). As craftspeople and farmers were both skilled by his definition and because America was rural and had virtually no factories, the claim that most people were skilled is plausible even though no aggregate statistics are presented in its defence. The Canadian economy was similar. At that time the proportion of "skilled" workers in England was much lower for it had already experienced considerable capitalist development.

According to Braverman, most jobs in today's economy are unskilled because they require very little training time and because the workers have no control over the pace or direction of their work. Thus, in the manufacturing sector only 38 percent of the jobs in 1970 were for craftspeople or supervisors (Braverman, 1974, p. 427); 49 percent were semiskilled and 13 percent were unskilled. Braverman contends that the semiskilled workers were in fact unskilled. In defence of this conclusion

he cites the U.S. Department of Labor's description of such work. These descriptions show that training periods for these jobs are very short, they are routinized, closely supervised, and often machine paced, and they make no requirement on the employee for conceptualization. All they require is adaptability and good health. Braverman (p. 431) concluded, "Is this not a definition of unskilled labour?"

Braverman contends that most service sector work and clerical work is of a similar sort. Training times are short, the pace of work is set by management and monitored in some way, and workers have no control over the nature or organization of their work. A rough calculation shows that close to 60 percent of the American labour force is unskilled in Braverman's sense.[10]

Many people regard computers as an example of the way modern technology raises skill requirements, but for Braverman the computer is a prime example of the way modern technology polarizes skills. The computer does generate some highly skilled jobs, but the biggest employment category created by computers (when he was writing) was key punchers. That job is an archetypically unskilled job. Thus, skill polarization.

Braverman directly challenged the claim that automation increased skill levels. This was the conventional view during the automation debate, but there were some dissenters and Braverman relies on their evidence. Prominent among them was James A. Bright, a professor at the Harvard Business School. Bright (1958) examined in detail the changes in jobs in 13 plants that were extensively automated. The theory that automation requires a major increase in skilled repair and maintenance personnel is a casualty of this inquiry. Overall, Bright's main finding is that automation leads to a decline in skill:

> A controversial area of this study will lie, no doubt, in my conclusions regarding the skill required of the work force in the automated plant. The relationship of skill requirements to the degree of automaticity as a declining rather than increasing ratio is not commonly accepted or even considered (as quoted by Braverman, 1974, p. 215).

Bright also examines in a more abstract way the effect of increased mechanization on a worker's control of his or her job and concluded that, except for low levels of mechanization such as power-assisted hand tools, increases in mechanization reduced the opportunities for individual control.

Braverman bases his case on entirely different evidence from the human capital school. He relies on detailed descriptions of job characteristics and training requirements. The human capital school relies on correlations of education and earnings. Braverman's evidence supports his conclusion that skill polarization has increased in the 20th century.

Since Braverman wrote, many attempts have been made to measure

changes in the distribution of skills. Spenner (1983) summarizes and evaluates this literature. Studies of the evolution of skill within an industry or trade often support Braverman's position. It may be, however, that this tendency is offset in the aggregate by the growth of industries, trades and occupations that require more skill than average. For instance, small businesses in the service sector have been increasing rapidly in number and their proprietors would be skilled workers by Braverman's definition. There have been attempts to measure the effect on skill of changes in the composition of jobs, but these investigations have been confined to relatively short periods of time (often only a decade) and most use the U.S. Department of Labor's *Dictionary of Occupational Titles* (1949, 1965, 1977) to gauge skill. Spenner argues that this source is biased against finding a change in the skill distribution, and, indeed, these studies usually find none. Clearly, measuring changes in the distribution of skill is of considerable importance. It would be desirable to measure the changes for the economy as a whole over a period of many decades.

Education

The human capital school is the orthodox position in North America, so, to displace it, the deskilling school must present an alternative analysis of education. This critique must explain the positive correlation of education and earnings and provide grounds for concluding that the rise in educational attainment does not indicate an increase in "skill" in any meaningful sense. There is not a consensus as yet among members of the deskilling school on these issues: they are still matters for further research; yet proponents of deskilling certainly believe they have made progress in resolving the issues.

Most proponents of deskilling accept that some of the increase in 20th-century educational attainment has contributed to economic growth. Some of the expansion of technical and professional education has been critical in developing modern technology, and, indeed, the increase in education among this group is half of the phenomenon of skill polarization. What is at issue is whether the rise in the educational attainment of factory, service, clerical, sales, and low-level managerial workers has made them more "skilled," more productive, or made any contribution to the growth in per capita income. There does not seem to be much question that a primary education has increased productivity in these jobs. The pertinent question is a marginal one: What has been the economic benefit of education beyond the primary years? Proponents of deskilling have offered two different answers to this question. Some have argued that increased education has not increased productivity and therefore neither augmented skills nor contributed to the growth in per capita income. Some others have argued that the increased education has raised productivity but done it by changing attitudes and personality

traits, rather than by conferring anything that might be called a skill. We will consider the variants in turn.

Ivar Berg's *Education and Jobs: The Great Training Robbery* (1970) is the classic statement of the position that increased education does not result in increased productivity. Braverman relies heavily on this book. The most persuasive evidence that Berg presents are statistical studies of individual productivity and educational attainment. A typical example is an investigation of 762 workers in a hosiery manufacturing factory. Each person's productivity could be measured because they were paid on a piece rate. On the day shift, productivity was independent of education. On the night shift, productivity declined with education (Berg, 1970, pp. 88–91). Berg (1970, pp. 92–101) presents similar evidence for clerical, sales and managerial personnel in the private sector. He concludes that there is no evidence that increased education leads to higher productivity. These comparisons do not exhaustively measure the effects of education on productivity. All of Berg's comparisons are within narrowly defined job categories. It may (or may not) be the case that more educated workers are more productive because they can perform different jobs. Berg's private sector comparisons do not test that possibility.

Berg (pp. 143–76) also discussed evidence about the relationship between education and productivity in the public sector. The most persuasive results are from extensive studies conducted by the American military on the determinants of success in technical training programs. These studies find no benefits to increased education. This finding is significant because it rules out an important way in which more educated workers might be more productive than less educated workers.

The finding (if true) that productivity and trainability do not increase in many jobs as completed education rises from primary to post-secondary contradicts the fundamental assumption of the human capital school that firms have minimized costs. That assumption implied that wage rates equalled marginal products and thereby removed the need for independent measures of productivity. But if a high-school graduate and a person who completed only grade eight are equally productive and if the market wage of the latter is less than the former's, then a firm that pays the premium to hire the high-school graduate is not minimizing its costs. Berg argues that firms are not cost minimizers in this regard, and he is amazed at the thoughtlessness of personnel managers in these matters. In interviews they invariably claimed that more educated workers were more productive, but they had rarely tested this belief with their own records, and, on those occasions when Berg was allowed access to them, he could show there was not the expected correlation between education and productivity. He found that a few companies had done such studies on their own, but they were exceptions (1970, p. 93).

Berg's explanation, then, shows no clear positive correlation between

education and earnings. The managers of American society have accepted the ideology that education increases productivity. By consistently acting on that belief they have created a society with a positive correlation between education and earnings. But, in fact, much of the increase in 20th-century educational attainment has made no contribution to economic growth. In fact, there has been no general rise in "skill."

Spence (1974) has provided a much more elegant theoretical analysis of the relationships among education, productivity and earnings. In some models, education does not increase an individual's productivity but serves as an effective screening device because, in equilibrium, more productive people acquire more education. Data consistent with such models would show positive correlations between education, productivity and earnings, but it would be a mistake to infer that the education difference was responsible for the earnings differential. In particular, the conclusion that a rise in everyone's education would raise everyone's productivity would be unwarranted. In other models, it is privately profitable for everyone to acquire the same amount of education. Consequently, there is no observable relationship between education and productivity. Spence (1974, p. 25, n4) cites Berg to show the pertinence of this result. An attractive feature of these results is that they are consistent with rational behaviour on the part of firms and individuals.

A group of radical economists have offered an alternative analysis of the relationship between education and 20th-century growth. The arguments have been developed most fully in Bowles and Gintis's *Schooling in Capitalist America* (1976). They deny that more highly educated workers have acquired more cognitive skills that make them productive. In that they agree with Berg. They differ from him, however, by asserting that more educated workers are indeed more valuable to employers. Their greater value is the result of changes in their attitudes and personalities. Thus, working-class high schools reproduce the hierarchial social relations of factory and clerical work, and teach obedience and the willingness to follow orders and tolerate routine. Four years in such a high school moulds a person's character so that he or she performs better in a routinized, deskilled job than does a grade eight school leaver. In contrast, a middle-class high school and a good university are less hierarchial and are devoted to the personal growth of the student. Such schooling prepares a student for the independent but responsible decision making required of a manager. According to Bowles and Gintis, education does affect people's ability to perform jobs, but the effect is achieved by forming character, not by teaching cognitive skills.

Many conclusions follow from this analysis of schooling. For the issues of concern here, two are important. First, Bowles and Gintis provide an explanation for the positive correlation between education and earnings that does not require denying that firms minimize costs:

they claim that more educated workers are indeed more valuable to firms. Second, the explanation for the correlation provides no basis for claiming that increases in educational attainment raise skill levels unless we are prepared to redefine "skill" to be a personality trait. It seems to me more honest (if we accept Bowles and Gintis's argument) to deny that much of the increase in education in this century has increased skill levels.

Berg's treatment of education differs from Bowles and Gintis's in important ways. Much research remains to be done to work out the radical critique of education. Whatever the outcome, it is surely an advance to incorporate evidence on the cognitive and non-cognitive effects of education into the economic analysis.

Real Wage Increase

The human capital school explains the 20th-century rise in real wages as the result of investments in education and of technical change biased toward using educated workers. Writers like Berg, who deny that education increases productivity, undermine that theory. Radical economists have proposed alternative theories to account for the rise in wages. These theories begin with the notion of segmented labour markets. There are many variations on the basic theory. Here we follow Edwards's (1979) synthesis.

He envisions the work force as divided into three segments: the independent primary market, the subordinate primary market, and the secondary market. The markets are of similar size. The independent primary market is composed of professional, managerial and craft jobs. The subordinate primary market is clerical and non-craft, mass production factory jobs. The secondary labour market includes small manufacturing, retail, service and any "casual" jobs. The three labour markets differ radically in terms of average pay, length of employment, and returns for education and experience.

Jobs in the subordinate primary and secondary markets are "deskilled." Secondary jobs pay very low wages and offer no returns to age or education. Subordinate primary jobs pay high wages and offer some return to age and education. How can this difference be explained? Edwards's answer, and the answer that would appeal to people like Berg who believe education does not affect productivity, is that the subordinate primary market is unionized whereas the secondary market is not. This cross-sectional comparison establishes that unions have a substantial impact on wages. Without unions, workers in the subordinate primary labour market would earn wages like those in the secondary labour market. Because wages in the secondary market are like 19th-century wages, unionization is responsible for the rise in working-class living standards.

There are three things to be said against this argument. First, real

wages in American manufacturing were rising well before the unionization of the main production industries in the 1930s. Second, real wages have continued to rise in recent decades even though the share of the work force unionized has declined in the United States. Third, for the comparison between subordinate primary and secondary labour markets to indicate anything about the effect of unions, it must be the case that the characteristics of the workers in the two markets be the same. Workers in the secondary labour market are less educated. If Bowles and Gintis are right about the effect of education on productivity, the cross-sectional comparison may show the economic effects of character differences rather than trade unions.

Radical explanations of the 20th-century rise in real wages are not in a satisfactory state. But then the human capital explanation for the rise was only incompletely worked out as well.

The Causes of Increased Skill Polarization

Suppose (to continue the argument) that much of the work force has become deskilled in the past century. Should we expect that trend to continue or might it be reversed? The answer hinges on the reasons deskilling has occurred. Braverman has offered the most systematic account, so we shall consider his argument. He claimed that deskilling occurred and skill inequality increased because these changes were in the financial interest of firms. There are two reasons for this. The first is an aspect of the economics of the division of labour.

Adam Smith (1937) claimed that the practice of the division of labour within a factory lowered costs by increasing productivity. He proposed three reasons to explain the productivity growth. First, the specialization of a worker in one task increased his or her dexterity at that task. Second, specialization in one task reduced the time in shifting among tasks. Third, specialization in one task concentrated the worker's mind on that task and led him or her to invent machines to facilitate that task. The reasons Smith offered are not very convincing. At best, the third is a long-run argument and does not explain why, at a point in time, a firm practising the division of labour would be more productive than an independent artisan. The second does not help much either. As in Smith's example of pin-making, an artisan could arrange to spend all of one day drawing pins, another day straightening them, and so on. There would then be no lost time. The advantages of the division of labour, then, must turn on the first reason: practice makes for dexterity. Surely this is true, but the returns to practice must decline eventually, and, indeed, in pin-making they would decline quickly. So it is not clear why a firm practising the division of labour should have higher productivity, hence lower costs, than a competent artisan.

Braverman claimed that Babbage (1835) first solved the problem. Babbage did not argue that a firm practising the division of labour would

have higher productivity than an artisan. Rather, he argued that the firm would have lower costs since it could purchase its labour less expensively. Thus, some of the tasks in pin-making required all of the skill of the craftsperson, but most of them could be done by unskilled children who commanded much lower wages. The division of labour allowed this substitution. Thus an artisan in competition with firms practising the division of labour would only receive a wage equal to the average wage of the firms. By working for a firm and specializing in that activity that required the acme of his or her skill, the craftsperson could realize the full value of skill. Hence, firms practising the division of labour displaced independent artisans.

For Braverman this argument is important, for it provides one motive for deskilling. Whenever a firm can break up a craft job into a sequence of tasks, some of which can be done by unskilled workers, the firm will break it up since its labour costs decline. The result is the destruction of crafts and the proliferation of deskilled jobs.

The second reason Braverman offers to explain increasing skill polarization is, to his mind, more fundamental, for he believes it to be an unavoidable consequence of capitalism. Under capitalism, employers own the capital of society and are the residual claimants of the firms' income. Workers receive a wage and have no incentive to work hard, because the extra output they might generate would accrue not to themselves but to the owners of the firm.

Deskilling is a solution to this problem. Workers can exert minimal effort only if they have discretion in the performance of their tasks. One reason workers in the late 19th century had discretion was because much factory work was still organized on a craft basis. Knowledge of how to perform the task was still vested in the artisan. Employers might fulminate that work should be done faster, but they did not really know how to speed it up, so the artisan could always deny it was possible. The solution to the impasse was for management to remove all knowledge from the workers, to transfer that knowledge to a planning department, to use that knowledge to design production processes in which workers had no discretion, and to use machine pacing (the assembly line is the archetype) to speed up the production rate. According to Braverman, this reorganization was the essence of "scientific management." It results, however, in skill polarization. The work force has been deskilled and a management department of highly trained engineers has been created. This is the second reason Braverman believed capitalism necessarily leads to the elimination of "middle" skills.

As noted earlier, Braverman believes that 20th-century economic history shows the working out of these imperatives. Today, in his view, most workers are deskilled while being managed by a bureaucracy of technocrats. Although this development was always in the immediate financial interest of the firms that advanced the process, it may not be in

their long-run interest. The first contradiction became apparent in the 1930s with the unionization of the mass production industries. This process was facilitated by the organization of work around the assembly line as it took only one employee to shut down the whole line. The second contradiction has appeared in the last generation. What scientific management did was produce factories that could be operated by unskilled peasants. There are many of them in the world and the opportunity cost of their time is much below the North American wage rate. The result has been the shift of manufacturing capacity from North America to the underdeveloped world. Many of the problems of international competition that confront North American industry today are results of the deskilled technology it has created.

The Future of Skill Polarization

Will skill inequality increase in Canada? The answer depends on whether Braverman has identified essential forces leading in that direction and whether policies can be designed to offset those forces.

We must have some doubts that Braverman has fully analyzed the incentives of firms to deskill their workers.[11] Recent work by neoclassical economists suggests that the skill level a firm chooses depends on the interplay between the interests of the firm and the preferences of workers (Rosen, 1974). This insight helps explain the success of "scientific management" early in this century and its apparent failure today.

Braverman's argument that the scope for discretionary behaviour on the part of employees must be eliminated makes strong assumptions about the psychology of workers — in particular, that they get positive satisfaction from greater income and negative satisfaction from exerting further effort. These are common assumptions, but they are not always true. They were probably true of the American work force early in this century. Most workers in American industry were immigrants. They were peasants from eastern and southern Europe who came to the United States with the intention of staying for only a few years and saving enough money to return to their homelands and buy property. Many did just that (Brody, 1960, pp. 96–111). They had no desire to master crafts. The motivation of these workers probably fits Braverman's assumptions. For that reason scientific management was a great success early in this century.[12]

Today, the work force is very different. Many people took to work as an opportunity for self-expression. They may, in other words, positively value work effort. Such people will feel frustration when given rigidly routinized work. Their productivity might rise if work were redesigned to increase the scope for discretion[13] (Ouchi, 1981). If motivation has evolved in this direction, we can understand how scientific management was once a source of productivity growth but is now an obstruction to advance.

There are, thus, two ways to reorganize work to increase productivity and avoid deskilling. One is to appeal to the new psychology of workers; the other is to blur or dissolve the employer/employee distinction. Both corporatist and radical reformers advocate both changes, but they put differential emphasis on them.

The most influential book by corporatist reformers has been Peters and Waterman's *In Search of Excellence* (1984). They put great stress on cheap expressions of positive reinforcement to reward high productivity. They aim to foster a sense of team spirit in which people can realize themselves in advancing the firm's interest. At times they sound like Rousseau in the stress they place on the founder who gives the firm this high productivity culture. (They have no specific suggestions on how to find more founders.) As far as organization is concerned, they advocate slimming bureaucracies, creating small and flexible managerial units, supplying workers with more information about the precarious financial health of their employers, and keeping factories small even if engineering considerations suggest there are further economies of scale. This last suggestion represents a return to the mid-19th-century managerial style. At that time, before the age of mass production and scientific management, factories were small enough so that the owner of the firm could motivate the employees by his personal leadership. That process broke down and scientific management was born when factories became larger and the separation of ownership from control began (Edwards, 1979, pp. 23–129). Peters and Waterman hope that today's plant manager can motivate his or her workers as did the entrepreneur of the pre-mass-production era.

Radical thinkers put much greater stress on dissolving the distinction between employer and employee. Bowles, Gordon and Weisskopf's *Beyond the Wasteland* (1983) and Reich's less radical *The Next American Frontier* (1983) are the central works. Neither book advocates socialism on the East European model. They aim to establish some form of industrial democracy so that workers have considerable control over the management of their firms and share financially in the greater income generated by their greater commitment. The "Hoopla" advocated by Peters and Waterman (pp. 263–66), if it came at all, would be the result of industrial democracy. "Corporatist alternatives will lead us on a detour. There is no substitute for the real thing" (Bowles, Gordon and Weisskopf, p. 332).

Conclusions

The arguments and evidence surveyed in this essay support the following conclusions about the effects of technological change:

- The aggregate evidence indicates that technological change has been a major cause of the increase of material well-being in the Western

world. Moreover, technological change has not caused a secular rise in unemployment.

- The history of technological change at the industry level indicates that sometimes technological change raises the income of everyone in society but that often technological change lowers some people's incomes while raising the incomes of others.
- Depending on the definition we choose for "skill" and the time period considered, it is possible to argue that skill levels have risen, fallen or remained unchanged. More efforts at careful measurement would narrow the bounds of disagreement, but the dispute is not simply empirical, for the various definitions of skill reflect differing visions of the good life for human beings.
- An important insight that emerges at several points is that technology does not evolve "on its own." Invention is a social process, so we can influence the types and characteristics of new technologies by the way we allocate research and development expenditures.

These findings are not sufficient to determine a Canadian policy toward technological change. A policy would depend on other considerations as well. However, to be reasonable, any policy ought to be consistent with the conclusions of this study.

Notes

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1. The model discussed here is similar in many regards to that in Newton (1983).
2. This statement assumes demand is less than infinitely elastic. Infinite elasticity implies an even larger induced increase in production, but is not consistent with a constant cost industry.
3. Under some circumstances, this conclusion must be modified when all the repercussions in the labour market are considered. If the consequence of the technical change were to increase labour demand, then the wage rate would rise because the supply curve of labour is rising. The rise in the wage further attenuates the labour demand increase. This effect reinforces the effect discussed in the text. At the same time, if technical change lowered labour demand, then the wage rate would fall. This fall would lower the product supply curve and increase output and labour demand. Depending on the elasticities of the various curves, the final outcome could be either an increase or a decline in employment. If this last possibility obtained, then the conclusion in the text must be modified in that the effect discussed there would be dominated by a related but contrary effect.
4. Note 3 describes the one circumstances in which this sentence will not apply.
5. Computed from Table 3-1 and Deane and Cole (1969, p. 143).
6. In the cotton industry, if we measure output by the consumption of raw cotton and employment as employment in factories plus handloom weavers, output per worker in 1806 was .208 = 57/(90 + 184) and in 1862 was .9934 = 452/(452 + 3). All figures from Table 3-1. Real national income per capita for 1800 and 1860 from Crafts (1983, p. 389).
7. The argument of this paragraph is based on Harley (1973).
8. This paragraph is based on Buck (1984) and Whiteley (1983).

9. Farmers fare badly at the hands of social scientists. They are usually assumed to be unskilled since farm wages are the lowest in the economy. But this inference confuses averages with marginals. The average farmer is highly skilled, but the wage of farmers depends on their marginal social product and that is low because agriculture is a declining industry.
10. Computed from the table in Braverman (1974, p. 379), assuming that all job classes shown are unskilled except for craftspeople.
11. Wood (1982) is an important critique of Braverman that develops arguments to this effect.
12. One wonders whether Lenin's enthusiasm for scientific management was a result of the similarity of the Russian work force to the American immigrant work force rather than simply a denial of socialist ideals. Compare Braverman (1974, p. 12).
13. The recent literature on "sociotechnical systems" theory provides some academic support for this claim. Newton (1984) provides a useful summary.

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Alternative Mechanisms for Dealing with Permanent Layoffs, Dismissals and Plant Closings

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Adjustment process issues pertaining to permanent and involuntary employee terminations are of particular policy concern within the labour market, not only because of the equity issues associated with the hardship they can cause, but also because of the efficiency implications of alternative policy responses. Such terminations are associated with a number of interrelated phenomena: plant closure and relocation decisions; the increasing number of dismissals that are contested in the courts; mass layoffs associated with trade liberalization and economic relocation; employee claims under bankruptcy; the problem of permanent obsolescence resulting from technological change; and the general increase in unemployment that has affected much of the world. The issue of permanent, involuntary terminations, and what to do about them, looms large with respect to each of these phenomena.

This paper examines the roles of three related mechanisms for dealing with the adjustment problems arising from permanent, involuntary terminations: the labour market and compensating wages; bargaining under a collective agreement and grievance procedure; and legislation and the courts, including employment standards legislation and court decisions with respect to wrongful dismissals. It is beyond the scope of this analysis to examine the array of government special adjustment assistance programs for workers, many of which are dealt with in Saunders (1981, 1984), Robertson and Grey (1985), and Canada Employment and Immigration and the U.S. Department of Labor (1984). A brief description of the issue of permanent, involuntary terminations is given prior to an analysis of the related mechanisms of the labour market, collective bargaining, and legislation and the courts.

Descriptive Overview

The lack of comprehensive data covering permanent and indefinite layoffs has been commented on in a variety of sources. "The Commission is concerned about the lack of data in the matter of redundancies and lay-offs. . . . There are no formal statistical arrangements between the federal and provincial governments to share information on lay-offs obtained in their respective jurisdictions" (Canada, 1979, p. 226). "One difficulty in analysing permanent layoffs is that we simply do not know the exact size of the problem" (Saunders, 1984, p. 2). "At the present time, there are no comprehensive data on permanent or indefinite layoffs occurring in Ontario: it is therefore impossible to know how many layoffs took place, and what the characteristics of those workers were" (Ontario Federation of Labour, 1981, Appendix IV).

In spite of this paucity of data, a partial picture can be sketched from information on a number of factors: job losers (as opposed to voluntary job leavers and new entrants and reentrants); permanent job losses and the extent to which they result from complete plant closures or partial closures and reduced operations; the income losses suffered by displaced workers; non-monetary consequences; and the effects on communities.

Job Losers

Since the labour force revision in 1975, Statistics Canada has compiled unemployment statistics that indicate the labour market experience of persons prior to their becoming unemployed. The unemployed are categorized into job losers (who lost their jobs or were laid off), job leavers (who left their jobs because of illness, personal responsibilities, school attendance, retirement, or for other reasons), new entrants (who never worked before) and reentrants (who had not worked in the previous five years).

Obviously there can be some discretion as to how people are categorized; nevertheless, the category of job losers corresponds most closely to the concept of involuntary separation analyzed in this study. The problems of new entrants (e.g., unemployed youth) or of reentrants (e.g., married women returning to the labour force) or the fact that some job leavers may have left their jobs involuntarily are all real. However, they are beyond the scope of this study, which focusses on involuntary separations, especially collective dismissals and ones that are unlikely to be temporary.

Table 4-1 gives a picture of the importance of job losers in both absolute terms and relative to the total unemployment rate, which has been rising over the period. In 1975 job losers accounted for 2.7 percent of the labour force — the largest component of the total number of

TABLE 4-1 Decomposition of Unemployment by Reason, 1975–83

Year	Components of Unemployment Rate by Reason for Unemployment				
	Job Losers	Job Leavers	New Entrants	Re-Entrants	Total Rate[a]
1975	2.7	1.9	0.4	1.8	6.9
1976	3.3	1.7	0.4	1.8	7.1
1977	4.1	1.7	0.5	1.8	8.1
1978	4.2	1.8	0.5	1.9	8.3
1979	3.6	1.5	0.5	1.9	7.4
1980	3.7	1.5	0.4	1.9	7.5
1981	3.8	1.4	0.4	1.9	7.5
1982	6.5	1.6	0.5	2.3	11.0
1983	7.0	1.6	0.5	2.6	11.9

Year	Distribution of Unemployed by Reason for Unemployed				
	Job Losers	Job Leavers	New Entrants	Re-Entrants	Total Rate[a]
1975	39.4	27.8	5.8	26.7	100.0
1976	46.3	23.3	5.6	24.8	100.0
1977	50.5	21.1	5.7	22.7	100.0
1978	50.3	21.1	5.8	22.8	100.0
1979	48.4	20.1	6.1	25.4	100.0
1980	49.7	19.7	5.5	25.2	100.0
1981	50.1	19.0	5.3	25.5	100.0
1982	59.3	15.0	4.4	21.3	100.0
1983	59.3	13.8	4.8	22.0	100.0

Source: Calculated from data given in Statistics Canada, *Labour Force, Annual Averages, 1975–83*, cat. no. 71-529 (Ottawa, February 1984), Table 46.

a. May not equal the sum of the rates in the first four columns because of rounding.

unemployed, accounting for 6.9 percent of the labour force. However, by 1983 job losers made up 7.0 percent of the labour force, an even larger portion of the rising unemployment rate of 11.9 percent. The extent to which this reflects a trend as opposed to a cyclical phenomenon remains an unanswered question, given the small number of years for which data are available.

The increasing importance of job losers relative to overall unemployment is illustrated more dramatically in the second panel of Table 4-2, showing the distribution of the unemployed. The proportion of unemployed who were job losers rose from 39.4 percent in 1975 to 59.3 percent in 1983, and this increasing relative importance of job losers occurred while the overall unemployment rate was increasing dramatically. Thus, job losses have increased dramatically in recent years, both in an absolute sense and even relative to a growing overall unemployment rate. The fact that the numbers of job leavers, new entrants and reentrants have not increased as much reflects in part the fact that many are reluctant to

TABLE 4-2 Job Losers as a Proportion of All Unemployed, by Sex, Marital Status and Region, 1975–83

Year	Total	Sex		Marital Status		
		Male	Female	Single	Married	Other
1975	39.4	48.8	27.1	34.8	43.9	34.2
1976	46.3	57.2	32.6	42.7	49.9	45.2
1977	50.5	61.1	37.1	46.3	54.8	45.8
1978	50.3	61.0	37.3	45.0	54.8	50.0
1979	48.4	60.4	34.6	44.6	52.3	46.4
1980	49.7	60.7	36.2	44.6	54.7	46.9
1981	50.1	60.7	36.9	45.5	54.9	46.8
1982	59.3	68.8	45.4	53.0	65.0	55.4
1983	59.3	69.5	44.4	53.2	64.8	56.1

Year	Region						
	Atlantic	Que.	Ont.	Man.	Sask.	Alta.	B.C.
1975	39.7	44.4	38.4	30.0	n.a.	32.4	39.1
1976	49.4	54.1	40.6	42.9	40.0	34.3	42.7
1977	52.4	56.7	47.1	40.7	44.4	36.6	46.9
1978	53.8	57.8	44.3	41.9	45.0	39.1	46.5
1979	53.5	53.2	45.7	44.0	38.9	31.7	44.2
1980	51.5	55.8	48.5	40.7	42.1	33.3	39.8
1981	57.7	56.4	46.1	44.8	38.1	39.1	44.0
1982	61.2	63.2	57.7	54.8	50.0	53.7	58.4
1983	61.9	61.6	57.6	54.2	54.3	57.5	59.9

Source: Calculated from data given in Statistics Canada, *Labour Force, Annual Averages, 1975–83*, cat. no. 71-529 (Ottawa, February 1984), Table 46.

leave their jobs or to enter or reenter the labour market when substantial numbers of other workers are losing their jobs.[1]

Table 4-2 indicates the severity of the job loss problem by sex, marital status and region. For example, in 1983, male job losers made up 69.5 percent of the male unemployed, and female job losers made up 44.4 percent of the female unemployed; the total job losers, 59.3 percent of all unemployed, represent a weighted average of the two. Clearly, the magnitude of job losses is disproportionately higher for males than females; nevertheless, it grew in relative importance for both males and females over the period, and in fact the relative growth was disproportionately higher for females than males. Similarly, the amount of unemployment attributable to job losses grew for all categories of marital status and for all regions. Clearly it has been an all-pervasive phenomenon in Canada since the mid-1970s.

Permanent Job Losers

Unfortunately, using the existing published figures, it is not possible to ascertain the extent to which the large and growing number of job losses

are of a permanent or temporary nature (with 13 weeks being the conventional dividing line between the two). While comprehensive data are not available to provide an accurate picture of the extent and growth of permanent as opposed to temporary layoffs, a partial picture can be drawn.

Using unpublished U.S. data for 1974, Feldstein (1975, p. 732) indicates that approximately 90 percent of job losers were either on permanent layoff with no job (61 percent) or on indefinite layoff from their existing job (27 percent). This would seem to suggest a fairly severe unemployment problem for the substantial and growing number of job losers, as documented previously. However, Feldstein's data also indicate that overall only some 43 percent of all job losers searched for a new job, with the proportions being 63 percent for those on permanent layoff and 12 percent for those on indefinite layoff. It appears that those on indefinite layoff expected to be recalled (or that they found waiting for a possible recall preferable to searching for a new job) and even that a substantial portion of job losers on permanent layoff were not unemployed in the conventional sense of looking for work. Whether they were too discouraged by the state of the labour market, engaged in non-labour market tasks, or had expectations of another job cannot be ascertained from the data.

In part because of this low rate of job search activity amongst job losers (especially among those on indefinite layoff and even among those on permanent layoff), Feldstein emphasizes the relative importance of temporary unemployment in what he characterizes as a dynamically changing economy. This characterization is buttressed by his earlier analysis of U.S. manufacturing in 1971, which indicated that firms rehired about 85 percent of the workers they had earlier laid off (Feldstein, 1973, p. 12). As Lilien (1980, p. 25) points out, however, this measure includes interestablishment employee transfers, which may involve substantial adjustment costs.

This greater quantitative importance of temporary as opposed to permanent and indefinite layoffs is also documented in Grey and Côté (1984, p. 5). Their analysis, based on the longitudinal labour force file maintained by Employment and Immigration Canada, indicates that permanent layoffs (defined as those never returning to the same employer) as a percentage of total layoffs for 1975 and 1978 were, on average, 32 percent in manufacturing, 52 percent in services, and 37 percent in the primary sector. While temporary layoffs still dominate in quantitative terms, permanent layoffs are quantitatively important and their qualitative consequences are obviously more severe.

Based on data from the Canada Employment and Immigration Commission (CEIC), the Ontario Ministry of Labour (1980) indicated that during 1980 in Ontario permanent and indefinite layoffs accounted for approximately 12 percent of all layoffs.[2] Ontario also compiles its own figures on permanent and indefinite layoffs. However, from the perspec-

TABLE 4-3 Permanent and Indefinite Known Layoffs in Ontario, 1974–83

	Reduced Operation & Partial Closure[a]		Complete Closure		Total	
Year	Estab.	Empl.	Estab.	Empl.	Estab.	Empl.
Fiscal Year[b] and Involving 25 or More Employees Only						
1974/75	64	9,210	46	4,207	108	13,417
1975/76	65	6,958	47	4,739	112	11,697
1976/77	75	9,066	67	10,778	142	19,844
1977/78	62	11,323	50	5,729	112	17,052
1978/79	36	5,615	41	4,944	77	10,559
1979/80	95	16,373	61	5,526	156	21,899
Calendar Year, Any Number of Employees						
1981	115	15,592	87	6,649	212	22,241
1982	237	38,514	109	10,871	346	49,385
1983	114	13,060	76	6,261	190	19,321

Source: Figures for fiscal year 1974/75–1979/80 from *Annual Review of Known Permanent and Indefinite Layoffs Involving 25 or More Employees, Ontario*, Research Branch, Ontario Ministry of Labour, annual reports 1975–80. Figures for 1981 to 1983 are from *Report on Permanent and Indefinite Layoffs in Ontario*, Plant Closure Review and Employment Adjustment Branch, Ontario Ministry of Labour.

Notes: This table excludes layoffs not covered by the Employment Standards Act, that is, in construction, and persons laid off because of unforeseen circumstances, bankruptcies or labour disputes.

a. The original report for fiscal years 1974/75–1979/80 referred to only "partial closures" for this heading. However, in a subsequent summary given in Ontario Ministry of Labour (1980, p. 14) the title "partial closures and general cutbacks" was used for the same figures, the latter term corresponding to the term "reduced operations." In the revised format for calendar years 1981–83 the figures are reported separately for reduced operations and partial closures, and are totalled here for convenience.

b. April 1 to March 31 of following year.

tive of providing a consistent and comprehensive times series, this data set entails some problems: the format has changed over time (from the fiscal year prior to 1980, involving 25 or more employees, to the calendar year after 1980, involving 50 or more employees as well as any number of employees); it excludes layoffs not covered by the Employment Standards Act (e.g., in construction and persons laid off because of unforeseen circumstances, bankruptcies or labour disputes); and it does not involve a systematic sampling or reporting basis, but relies on local CEIC officials obtaining information from such sources as Canada Manpower Centres, the Unemployment Insurance Commission, the Ministry of Industry and Tourism, newspapers and others. In spite of these problems, the data set does provide some information, especially on the reasons for permanent and indefinite layoffs.

As indicated in Table 4-3, the number of employees laid off permanently or indefinitely has increased substantially since the mid-1970s;

the annual variation has been quite volatile, with record numbers in 1982 and a subsequent sharp decline in 1983. Within this period, approximately one-third of the permanent layoffs resulted from complete plant closures, and two-thirds resulted from reduced operations and partial closures.

Although not reported in the table, the original reports indicate that most permanent and indefinite layoffs occurred in the manufacturing sector and in communities of 100,000 or more persons. The proportion of permanent and indefinite layoffs that occurred in such larger communities was 55 percent in 1974/75, 44 percent in 1975/76, 61 percent in 1976/77, 45 percent in 1977/78, 61 percent in 1978/79, and 77 percent in 1979/80.

Extent of Income Loss Suffered by Displaced Workers

When workers are displaced to their next-best alternative activity they will invariably suffer a welfare loss. In most circumstances, all that can be measured, however, is the income change (usually a loss) with perhaps some adjustments for differences in such factors as working and living conditions and leisure.

Jenkins et al. (1978), for example,[3] have estimated the expected income losses of workers in Owen Sound, Ontario, and Sherbrooke, Quebec, who lost their jobs because of trade liberalization. Private income losses (i.e., based on after-tax calculations of wages, unemployment insurance, and a valuation of leisure when unemployed) in 1977 dollars and over a three-year period were $2,115 for workers in Sherbrooke and $4,797 for workers in Owen Sound, respectively, representing 10 and 15 percent of the workers' wages prior to layoff. The higher loss was suffered by older, higher paid, and permanent workers; the lower loss by the younger, lower paid, and more temporary workers. The private losses tended to persist for about five years and resulted more from increased unemployment than reduced wages; such losses also were higher when the economy was in recession. Jenkins et al. estimated the effects on the economy as a whole to be substantially larger, at $25,000 per laid-off worker, or 48 percent of the former wage bill, in Owen Sound, and $21,000 per worker, or 43 percent of the wage bill, in Sherbrooke, in 1971 dollars amassed ten years after the layoffs. These higher costs reflected multiplier effects and adjustments for the effects on other workers, as well as increases in transfers and reductions in taxes paid to the community.

An important aspect of such income-loss calculations is the extent to which they are offset by gains that would provide the potential to compensate the losers. Presumably, in the absence of any market failure, the market reallocation that is causing such displacements must be a move toward ultimate efficiency involving the reallocation of resources

to their most valued use. The potential profits or gains from trade in fact are driving the change. For example, calculations indicate that the five-year income loss for textile workers in Sherbrooke, Quebec, who were displaced by liberalized trade, was in the neighbourhood of $20,000 per worker, compared to the efficiency losses of $30,400 from trade restrictions (Saunders, 1984, p. 18, based on estimates from Glenday, Jenkins, and Evans, 1982).

Non-Monetary Consequences

The extent of income loss is only one component of the adjustment consequences faced by workers who experience some form of involuntary severance. On the economic side, such workers may also lose the investment made in their homes (especially because the economic declines that cause job losses usually reduce the demand for housing) and they may incur significant costs in connection with the search for a new job, mobility, and retraining.

On the non-economic side, the socio-psychological consequences layoffs have on the individual have been well documented and discussed (e.g., Eleen and Bernardine, 1971; Stern, Wood, and Hammer, 1979; Canada, 1979; Gordus, Jarley, and Ferman, 1981; Saunders 1981, 1984; and Bluestone and Harrison, 1982). Perhaps the most comprehensive analysis, based on U.S. data, is by Brenner (1976), who indicates that increased unemployment is associated with increased numbers of suicides, homicides, admissions to mental hospitals, and prison terms, as well as of stress-related diseases such as cirrhosis and cardiovascular-renal disease. While not readily amenable to measurement, the costs and other consequences associated with these problems must be added to any measure of income loss associated with worker displacement.

Community Consequences

The consequences of layoffs can also spread beyond the individuals and their families to the community at large. In particular, layoffs may have ripple effects through backward linkages to suppliers (e.g., automobile parts manufacturers) and forward linkages to wholesalers and retailers (e.g., automobile distributors and dealers).

Such community consequences are particularly severe when whole communities are involved, such as when there is a plant closure in a one-industry town. Such communities can lose their tax base at the precise time when demands for social services (e.g., hospitals, police, welfare) are highest. Just as individuals in declining communities become reluctant to invest in the upkeep of their own property, so is there a collective reluctance to invest in the maintenance of a costly social infrastructure; both private and public community deterioration set in.

Summary

This description of the problems associated with involuntary severances of a more permanent nature is replete with known facts. We know that such problems exist and that the consequences for individuals, their families, and their communities are severe. In addition, the quantitative significance of layoffs has grown through the 1970s and into the 1980s. While this may have been an unusual period in terms of the severity of some of the exogenous shocks (e.g., energy costs), others such as de-industrialization, technological change, and changes in world trade patterns are likely to be with us for some time, and both the positive and negative aspects of such changes are likely to be exacerbated in Canada, given the openness of our economy.

The question, then, does not seem to be whether or not involuntary permanent layoff is a large and growing phenomenon. Rather, the issue is the extent to which this is a permanent phenomenon and what, if anything, should be done about it. In other words, appropriate policy responses are not likely to change dramatically if the magnitude or severity of the phenomenon is slightly larger or slightly smaller than the basic descriptive statistics seem to indicate. Thus, the real question is what, if anything, is the appropriate policy response? The answer to that depends in turn upon the extent to which the phenomenon is likely to be permanent and the extent to which mechanisms for regulating the employment environment — the market and collective bargaining — can be expected to handle the problems associated with involuntary severances.

Market Response

The labour market will respond to problems associated with layoffs, dismissals and plant closures. Whether the response is socially optimal is another issue (dealt with in part in a subsequent section); however, there will be a response, and understanding that response is important for two reasons: first, the response may put cost pressures on employers to reduce the number of layoffs. dismissals or plant closures, at least relative to the situation where there were no labour market responses; second, exogenously imposed public policies to deal with layoffs, dismissals and plant closings may engender a labour-market response to these policies which may offset, at least in part, the intended effects of such policies.

Compensating Wages

According to neoclassical economic theory, the basic market mechanism, or price, that will adjust to ensure that employees take account of

(i.e., internalize) at least some of the cost consequences of layoffs, dismissals and plant closings is the wage rate paid for work that is vulnerable to these phenomena. In a competitive world of perfect information and no externalities or market imperfections (assumptions that will be relaxed subsequently), firms with high layoffs or in which there are risks of dismissals or plant closures would have to pay a wage premium for the occupational hazard associated with such phenomena. Conversely, firms that offer implicit or explicit contracts offering a degree of employment security or severance pay are in effect offering private unemployment insurance, with the lower compensating wage being the insurance premium paid by workers. Even if information were not perfect and there were other market imperfections, some compensating wage would tend to be paid so as to compensate for the risk of unemployment.

The competitive paradigm does not dictate that all workers be willing to leave an employer should such a compensating wage premium not be paid. All that is required is that there be some workers at the margin of decision (i.e., indifferent to either leaving or joining the company) for it to become necessary to pay the compensating wage premium in order to retain or recruit such employees. Others who are willing to stay because of a strong preference for the particular employment, or the lack of alternatives elsewhere, or so as to amortize their quasi-fixed costs over a longer period, would receive a rent or seller's surplus providing the firm could not differentiate between them and the workers at the margin of decision.

Complicating Factors

This picture is complicated by the fact that other things are not usually constant in scenarios where compensating wages are paid. In particular, when layoffs, dismissals and plant closures are prevalent, it is likely that demand is falling and this would imply falling wages, not wage premiums to compensate for the likelihood of the events occurring. Nevertheless, for a given level of demand, even a falling demand, market forces should lead to some wage premium to compensate for the risk of the event. Alternatively stated, if two firms faced the same declining demand, but one managed the decline with a minimum of labour disruptions such as layoffs, dismissals or plant closures, and followed less disruptive policies such as adjusting through attrition, early retirement programs, or work sharing, then it should be able to pay a lower compensating wage because of its better severance policies.

However, the picture becomes complicated again by the fact that if there are excess profits or rents to bargain over, then the employer may use the threat of such severances to extract concessions. Other things are seldom constant, and such factors as the level of bargaining power or

the level of demand may complicate the relationship between compensating wages and risks associated with various forms of severance. Nevertheless, the point remains that, holding other factors constant, competitive economic forces would lead to compensating wages for such risks, just as for any other job risk or undesirable working condition.

The market mechanism is further complicated by the fact that it is an ex ante premium paid for the probability of risk associated with the various forms of severance. Afterwards, of course, if the worker experiences the severance, then that worker loses not only the regular wage but also the compensating premium. This fact may account for some of the substantial income loss that appears to occur for workers who lose their jobs; some of their wage loss may be the loss of the ex ante wage premium paid for the probability of the risk that has ex post come to be realized. The income loss may also be substantial, reflecting a loss of union wage premiums or the fact that the firm may have been paying in excess of the competitive wage to reduce unwanted turnover or to get worker loyalty, rationales that are obviously less important in times of mass layoffs.

Equity and Efficiency Implications

The compensating wage adjustment mechanism has implications for both equity and efficiency. The equity implications stem from the fact that the losers may already have been compensated beforehand for the severance risk, and the greater the severity of the risk the greater the prior compensation and the greater the income loss after the fact, should the event occur. Policy measures to compensate such losers may involve double compensation — that is, compensation through both a market wage premium and a policy transfer. However, once the transfer is known and anticipated by the private actors, then the real, uncompensated risk should dissipate (since it is compensated for by policy transfers) and so should the market-compensating wage premium. In such circumstances the relevant policy question becomes: What is the socially preferred mechanism, ex post compensation through government transfers, or private market arrangements involving ex ante compensation through wage premiums?

The compensating wage mechanism also has efficiency implications. In particular, under competitive conditions it ensures that firms pay — at least in part — for the expected risk associated with their severance policies. In turn, this cost pressure ensures that they pay at least some attention to the ultimate consequences of their layoff policies. (Whether or not the cost consequences are fully accounted for, leading to the socially optimal severance policy, is a more difficult issue that will be addressed subsequently.)

In perfectly competitive markets the internalization of the cost consequences through the competitive wage mechanism also ensures that firms will adopt the most efficient adjustment strategy. Depending upon a firm's own specific cost conditions, a number of different worker adjustment policies are possible:

- the provision of stable employment even at the expense of retaining redundant workers;
- implementation of marginal adjustments through attrition, early retirement policies or work sharing;
- the provision of severance pay or voluntary buyouts;[4]
- simply laying off workers and accepting the higher compensating wage that likely will have to be paid to recruit workers in such a risky environment.

In a competitive, unregulated market, firms will choose the most efficient severance arrangement according to the specific technological and cost constraints acting upon them.

On the other side of the market, workers in this competitive environment would sort themselves into jobs based in part on their own preferences and degree of aversion to the risks associated with the alternative severance scenarios.[5] Those who are averse to risk or tied to a particular place of employment would opt for the firm that tries to maintain a reputation as a stable or fair employer. Such employees pay an insurance premium in the form of accepting lower wages in return for such job security. The contract may be explicit (e.g., as part of the company personnel policy or a collective agreement) or it may be implicit (e.g., as part of a reputation-building strategy followed by the firm). In contrast, workers who are more willing to take risk, or who are more capable of diversifying the real risk of job loss (e.g., those who have not also invested in a house in the area), or who are more mobile may opt for the riskier job and save on the insurance premium by taking the higher compensating wage.

This situation also encourages workers to adopt the most efficient adjustment strategy for their particular circumstances. As an example, this may involve diversifying risk by not buying a house in the same community or by acquiring training that is generally applicable in a variety of employment environments, rather than in only one specific environment.

In this competitive model, in the absence of any market failure, the price system compels the parties to consider fully (i.e., internalize) the private cost consequences of the various forms of employee severance by the compensating wage mechanism; to the extent that there are no externalities, then the social consequences are also internalized by the private parties and the market would yield the optimal severance procedures. The compensating wage mechanism would also provide the

cost pressure needed to ensure that employers take proper precautions and make adequate preparations for the possibility of severances, given their own particular cost constraints and preferences. This may involve adjustments before, during, and after severance. The adjustments would be neither frivolous nor unreasonable since the parties themselves would be required to trade off their legitimate concerns about job security against the very real costs of providing such job security. Ultimately, the market would also ensure that the adjustment was made in the least costly manner, with adjustment consequences and the residual risk being located beforehand, where its cost consequences are minimized. This may entail, for example, the provision of seniority rights to older workers who, generally speaking, are at a stage of their lives when it is most difficult to bear the risk of layoff.

Whether the market does, or ever could, work in this neoclassical, stylized fashion is a question that is unlikely to be answered or agreed upon consensually. Nevertheless, even if the market does not work perfectly in this area, it is likely to exert very strong pressures in the directions discussed above. The key policy issue then becomes how best to harness those pressures to make them work in a socially desirable fashion, without prejudicing their ability to pressure the private parties to deal with severance problems in a humane and cost-effective fashion, and ensure that all parties act appropriately before, during and after the event.

Clearly, a perfectly functioning competitive market with compensating wages is one mechanism for dealing with the problem of involuntary severances. In fact, in the absence of market imperfections and failures, the market mechanism could yield the socially efficient amount and form of such severances. What, then, are the possible sources of market failure that could prevent such a mechanism from handling the problem of severances in a socially optimal fashion?

Possible Market Failures

The previous discussion analyzed how a perfectly competitive market with no externalities would deal with the private and social consequences of layoffs, including mass dismissals. Problems arise, however, when markets either do not exist, or operate imperfectly when they do. Such possibilities are associated with a number of phenomena that may merit government intervention. With respect to permanent layoffs, such possibilities are discussed here under the rubrics of externalities (pecuniary externalities, congestion externalities from mass layoffs, and public goods problems of innovative industrial relations policies); market imperfections (imperfect and asymmetric information; non-competitive and non-economic constraints and adjustment costs); insurance market failures; and equity failures.[6]

Externalities

The classic rationale for government intervention in an otherwise private market economy exists when there are externalities or third-party effects and the market does not automatically extract sufficient payment for the parties to internalize fully the resultant costs or benefits. The previous discussion, however, indicated how ex ante compensating wages were the pricing mechanism whereby the market internalized the consequences of risk associated with the possibility of layoffs. Alternative private market arrangements such as voluntary buyouts, supplementary unemployment insurance benefits, retention of redundant workers, and compliance with orderly layoff procedures perceived as just can all serve to enhance the firm's reputation as a good employer and reduce the residual risk associated with layoffs.

Some parties will, of course, lose after the fact: some firms may have paid too high a wage premium in the sense that the expected number of layoffs may never come to fruition; others may have paid too little in the sense that the severity of the layoffs turn out to be greater than anticipated. Hence the rationale for insurance arrangements, including those between employers and employees, such as severance pay.

Pecuniary Externalities

The market will also lead to third-party effects through its forward and backward linkages, because the wages and probabilities of employment for workers in related fields will adjust to the resulting demand changes. However, these are pecuniary externalities working through the market mechanisms, which include related wage changes. They are a sign that the market is functioning, not failing (albeit the consequences can be severe for the losers), as related resources are reallocated to their most valued use.

The severe income losses experienced by the displaced workers themselves also represent a pecuniary externality, for their income drops when they are displaced to the next-best alternative activity. Some of the loss may be a loss of rents (e.g., a union wage premium), in which case what they lose is offset by a gain to their subsequent employer. Such transfer externalities, while they can have important distributional consequences, have no direct efficiency implications, even though they may have indirect efficiency implications in markets distorted by second-best constraints (discussed subsequently).

There are, however, at least two situations in which the possibility of real (as opposed to pecuniary or transfer) externalities may prevail in layoff situations: one is the possibility of congestion externalities associated with mass layoffs; the other is the possibility that firms may be reluctant to engage in innovative personnel policies with respect to layoffs because of an inability to patent, copyright or appropriate the full return on their investment in this area.

Congestion Externalities from Mass Layoffs

Mass layoffs,[7] especially in small isolated communities where workers have roots, may create significant congestion externalities as large numbers of unemployed workers enter a labour market strained to capacity in the sense of being unable to absorb the new unemployed without affecting the job search of others. With smaller layoffs, and in large communities, individual workers who have been laid off have no appreciable effect on the probability of others finding jobs. They bear the consequences themselves, with minimal effects on third parties. In the case of mass layoffs in small communities, however, the labour market may be unable to absorb the layoffs; the capacity constraint is binding. On entering the pool of unemployed, individual workers take only their own cost consequences into account; they do not consider the costs imposed on others in the pool of unemployed, who may now have to search longer and harder. In the absence of any price mechanism to internalize the externalities, the labour market may yield an amount of such unemployment that is greater than socially optimal.

While the possibility of congestion externalities resulting from mass layoffs is intuitively appealing, there are arguments to suggest that it may not be a source of market failure. First, a price mechanism does exist: ex post (i.e., after the mass layoff) the reservation wage of workers may fall more rapidly in situations of mass, as opposed to individual, layoffs,[8] and ex ante (i.e., before the layoff) a compensating wage, reflecting the likelihood of a mass layoff, may have been paid. Second, new firms may enter to take advantage of the pool of available labour, especially if reservation wages have fallen. Third, many isolated communities may consist of itinerant workers who would leave the area soon after a mass layoff occurred.

Even in the case where whole communities are affected, a market mechanism does exist. After a mass layoff, such communities (including provinces) can bid to try to attract new firms by offering appropriate location incentives, and rationally the price they charge may be low, reflecting the low social opportunity cost of their public infrastructure, such as road, water and sewage, and education systems. Such competition may appear to be ruinous as different communities compete with each other to attract new industry; however, it may obviously reflect the rational allocation of public infrastructure, some of which may have a social opportunity cost that is close to zero. If such competition does not attract new industry, then presumably this reflects the market's evaluation of the worth of the public infrastructure; the costs should be regarded as sunk costs from the perspective of the efficient allocation of society's public infrastructure. After the fact, there may be an overinvestment in social infrastructure, given the mass layoffs, and allowing the infrastructure to deteriorate may well represent the least costly alternative. The equity implications of such a policy can of course be severe, and are discussed subsequently.

Thus, the theoretical possibility of congestion externalities from mass layoffs is certainly open to question. The problems associated with mass, as opposed to individual, layoffs may seem large because, by definition, large numbers are involved (i.e., it is a quantitatively large problem but not one that, qualitatively speaking, is any greater than that caused by an equivalent number involved in a series of small layoffs) and in the case of mass layoffs, by definition, inframarginal workers are involved and may lose substantial rents as they are displaced to their next-best alternative. In addition, the visibility of a mass layoff can be politically important in moving governments to provide adjustment assistance.

However, to the extent that the market may fail to internalize fully the cost consequences associated with congestion externalities originating from mass layoffs, a number of interesting policy consequences follow. This would be a justification, for example, for a number of policy initiatives that would give preference to mass layoffs over individual layoffs; advance notice that is greater for mass layoffs than for individual layoffs (as exists in many jurisdictions, as discussed subsequently); special adjustment assistance to designated communities and industries (e.g., Industry and Labour Adjustment Program); favouritism shown in ad hoc bailout decisions to firms that dominate a local labour market; and preferential hiring rights in business relocations and closures.[9]

In essence, the case for government intervention becomes stronger in the situation of mass permanent layoffs than temporary layoffs or even individual permanent layoffs. Temporary layoffs, where the employee expects to be recalled by the same employer, may represent an efficient way of dealing with cyclical changes in demand and be part of the implicit contract between employers and employees. The downward adjustment may occur on the employment rather than the wage side for a number of reasons: unemployment insurance may cushion the consequences of an employment adjustment; the consequences fall disproportionately on those with little seniority, who may be able to absorb the reduction of employment better than workers with more seniority could absorb a wage cut; with asymmetric information on the true nature of the demand shocks, employees may accept the possibility of an all-or-nothing employment reduction as opposed to a marginal wage adjustment, because employers are less likely to attempt the bluff that demand conditions are adverse if they know that this means they would have to reduce employment rather than wages — the employment reduction involving a cost to employers if demand conditions are not adverse. For these various reasons employees may prefer an implicit contract that involves periodic bouts of temporary unemployment to one that involves wage reductions. The rationale for government intervention in such a situation may be tenuous, and in fact government support through unemployment insurance (discussed subsequently) makes such an arrangement more likely.

Even permanent individual layoffs may be socially acceptable to the extent that they represent the market response to permanent demand changes and/or to a mismatch between the employee and the job requirements. The consequences may be severe (and hence government intervention may be justified for reasons of equity); however, they are likely to be internalized by the parties themselves, through adjustment in the employee's reservation wage and the firm's wage offers.

In the case of permanent mass layoffs, however, to the extent that real congestion externalities do arise, the case for government intervention is better justified, even on efficiency grounds. This corresponds with our intuition (and the actions of policy makers) that the consequences of layoffs are more severe when an employment cut of a given size is concentrated in a particular small community in which the labour market is already at capacity with respect to its ability to absorb the unemployed. It also corresponds to our notion of horizontal equity, that it seems fairer to distribute employment losses across a larger number of persons than to concentrate them on a few.

Public Goods Problems with Innovative Policies

The second real externality that may arise in connection with permanent layoffs occurs because of the general proposition that, as a result of the absence of copyright and patent rights, employers may not be able to gain the full benefits of an innovative personnel policy that deals with layoffs. If the policy is successful, other firms can emulate it at no cost in terms of research and development; if it is a failure, the innovative firm bears the full cost. The most such a firm can hope for is that its successful innovation will give it a lead in the market (and perhaps that it can set up a separate consulting operation to market its new policy to other firms). Nevertheless, this is unlikely to be sufficient for it to reap all the potential benefits.

Once the information is available, it has some of the dual characteristics of a public good: the information is equally available to all and it is not possible to exclude non-payers. In such circumstances the market is likely to yield a socially suboptimal amount of such goods. This is a general problem with regard to information and innovation (including general labour market information, which is often provided through the public sector), and it applies equally to innovations with respect to industrial relations policies in general, including those pertaining to layoffs.

For example, a number of such policies were discussed previously with respect to how firms may seek to ameliorate the consequences of layoffs through such procedures as attrition, early retirement programs, work sharing, and smoothing out demand fluctuations. It is true that firms can reap the benefits of such established policies by being able to pay a lower compensating wage for providing them. However, for the reasons outlined earlier, they cannot reap all the benefits of successful

innovations in such policies, although they pay the cost of unsuccessful ones. For this reason, it may be perfectly rational for firms not to engage in such innovative personnel policies, including those associated with permanent layoffs. The market may eventually provide such policies; however, their general use may be much slower than would be the case if the innovators were to reap the full benefits.

Thus, it may not be in the interest of an individual firm to invest considerable resources in finding out about lifetime commitment systems in Japan, or job enlargement programs in Sweden, or early retirement policies in Europe, or work-sharing arrangements elsewhere. However, it may be in their collective interest to do so. Hence, there may be a rationale for public sector intervention in the collective provision of such information, or in the support of pilot projects for such policies.

Market Imperfections

While the existence of externalities provides the clearest theoretical rationales for government intervention in the case of permanent layoffs, a number of possible market imperfections have also been used to justify such intervention. In many circumstances, however, governments will face similar problems arising from imperfections and, hence, the real question for public policy becomes: Does government have a comparative advantage when dealing with these problems, so that an imperfect government solution is better than an imperfect private sector solution?

While there are a variety of ways of categorizing market imperfections with respect to permanent layoffs, most can be encompassed under the categories of imperfect information, non-competitive and non-economic constraints, and adjustment costs. In essence, many of these categories involve relaxing what are considered to be some of the unrealistic assumptions of the competitive model, and tracing through their implications for how markets deal with the problem of permanent layoffs, especially through the compensating wage mechanism.

Imperfect and Asymmetric Information

Uncertainty and imperfect information about the nature of exogenous shocks that can lead to permanent layoffs (e.g., changes in demand, interest rates, imports, energy prices) can make it very difficult to predict the likelihood of permanent layoffs and plant closures. This makes it difficult for workers to demand ex ante compensating wages in return for the probability of the event or to devise their own adjustment and diversification strategies. The problem, however, is that the uncertainty is real and that information is costly, not only for employees but also for governments. None of the parties may have much information about the likelihood and severity of such exogenous shocks and how they will translate into permanent layoffs.

There is an asymmetry, however, in that employers may have better information, but may not disclose it for fear of losing customers (especially where warranties are involved), suppliers (who may charge a risk premium on their credit), distributors, and workers (the best of whom may leave for more secure alternatives and the others who may suffer morale problems). In addition, if employers do disclose such information in order to extract concessions from employees, it is difficult for workers to know if employers are simply bluffing in order to get wage concessions. In such circumstances, in order to elicit truth-telling on the part of employers, since layoffs are likely to be more costly to employers than wage reductions, employees may bargain for rigid wages and allow the demand shocks to be absorbed in employment reductions.

The public goods nature of information that is in the public domain creates an additional problem, the more so for general forecasting than for firm or industry forecasting. In such circumstances, governments may have a comparative advantage in providing the information collectively, paid for out of general tax revenues. In fact, this is done through forecasting exercises as well as labour market information programs.

Non-Competitive and Non-Economic Constraints

In order for compensating wages in the market to internalize fully the residual risk consequences of permanent layoffs, markets must be competitive. Obviously, the labour market is riddled with non-competitive constraints, especially those that raise wages above the competitive norm, such as unions and wage-fixing legislation (e.g., minimum wages, fair wages on government contracts, wage extensions by decree, and equal pay legislation). The adverse employment effect predicted by basic economic theory to arise from such policies may take the form of permanent layoffs, especially in adverse economic conditions, if such arrangements prevent wage flexibility from reducing employment cuts. (In the upswing, they may simply lead to reductions in the rate of new hiring rather than actual layoffs.)

Non-economic constraints may also prevail. For example, multinationals may close more profitable plants in a foreign country rather than less profitable ones in their own because of political pressure at home. In addition, they may be reluctant to sell an overseas plant for fear of additional competition, or because it does not have much value without its particular connections with its head office or other firms in its multinational chain. This reasoning seems to lie behind the belief that many multinationals close plants that are profitable, thereby causing unnecessary mass layoffs.

The non-economic constraints may also reflect political pressures. For example, laid-off workers will likely be assisted by public transfers in the form of unemployment insurance, and possibly welfare; in fact, the expenditures may be even higher if increased crime or health problems result. In such circumstances the government may regard it as

cheaper simply to support the retention of jobs — for example, through wage subsidies. Obviously this could not continue indefinitely, as social expenditures are likely to be higher if labour is not ultimately transferred to its most valued use. However, it may be considered a stop-gap if the economic climate is expected to improve.

Adjustment Costs
Even if the new equilibrium is ultimately more efficient, adjustment costs can be substantial and involve a significant loss of real resources. Waiting for the wage adjustments to serve as the market signal for reallocation may be costly, especially if the market overreacts (e.g., as in the cobweb adjustment models discussed in Saunders, 1984, p. 13). In such circumstances it may be preferable to move more rapidly to the ultimate equilibrium. This is straightforward, of course, if the new equilibrium is known with certainty; however, the problem occurs when there is uncertainty, in which case it is not clear that the speed of the market adjustment process is suboptimal (except perhaps because of the public goods nature of information in the public domain, as previously discussed). In other words, adjustment costs are real; they do not disappear with government intervention.

Insurance Market Failures

Since unemployment is a risk, we would normally expect private markets to provide insurance against it. Unfortunately, the emergence of such markets is inhibited by the usual problems that face insurance markets — moral hazard and adverse selection. The moral hazard problem occurs because the private parties themselves can influence the likelihood of the risk of being unemployed: employers can lay off workers and workers can quit or behave in a way that increases the likelihood of their being laid off. The adverse selection problem exists because employers or workers with high unemployment probabilities would be the most likely candidates to buy the insurance. If such high risk candidates could be identified and a higher insurance premium charged, then this could substantially abrogate the insurance function since those subject to the risk would pay more, in this case in the form of high insurance premiums. For these reasons, conventional private insurance companies tend not to offer unemployment insurance.

Nevertheless, private insurance arrangements are possible. As discussed previously, employers can offer implicit or explicit contracts with a degree of employment security (even if it means retaining redundant workers) in return for paying a lower compensating wage to make up for the risk of unemployment. The employer acts as an insurance agent (as well as a producer of goods and services), with the firm's employees paying the insurance premium in the form of accepting lower wages. The

moral hazard problem is mitigated by the fact that the firm has considerable control over the layoff decision. In such circumstances, risk may be efficiently located, in that the firm has the resources to bear the risk and diversify it through the stock market or through a diversified portfolio of activities. It is true that the firm still faces a moral hazard problem to the extent that employees can modify their behaviour to increase their chances of collecting the insurance (i.e., being retained by their employer without a wage cut, even though their services are largely redundant). For example, they may shirk on the job knowing that the firm tends to follow a no-layoff policy in its insurance function. Nevertheless, such employees risk dismissal (analogous to losing the insurance claim) and the firm has other personnel policies to ensure that the employees' actions are compatible with the objectives of the firm (i.e., to facilitate incentive compatibility). As Carmichael (1980) points out, firms may base layoffs on seniority in part to discourage workers from trying to be laid off or being made redundant if the costs of layoffs or redundancy are reduced.

Firms are also able to mitigate the adverse selection problem through the hiring procedure. That is, they can try to screen out candidates who are at high risk of being redundant and are trying to obtain employment in a firm that offers unemployment insurance in the form of job security in return for paying a lower wage. In effect, the adverse selection problem is lessened by the fact that the firm provides insurance only to its own employees, a group for which it has considerable information and to which it can control entry. This is analogous to being able to provide low-price group insurance to a low-risk class if one can control entry into the group and hence prevent adverse selection from dissipating the market.

Firms may provide more overt forms of unemployment insurance in such ways as supplementary unemployment benefits to top up state unemployment insurance. In some sectors such as the automobile industry, these supplements can be substantial and, in effect, provide a guaranteed annual income. Clearly, in these circumstances, the moral hazard problem becomes great because the worker is almost fully insured. Hence, it is not surprising that these institutional arrangements tend to exist in unionized sectors, where strict seniority rules (rather than individual behaviour) govern the layoff decision. In that vein, the two-tiered arrangement may be a way of minimizing the moral hazard problem, since the party providing the top up (where the moral hazard problem becomes greatest) has considerable control.

While private insurance arrangements, especially those provided by the employers themselves, can exist, they are still subject to elements of adverse selection and especially moral hazard, as previously discussed. In addition, individual employers who provide the insurance as part of an implicit or explicit contract may find it difficult to diversify the risk,

since the risk of unemployment is positively, and not negatively, correlated with their own specific product market conditions. That is, retaining redundant workers or paying them unemployment compensation comes at the very time when firms are least able to pay. This raises the possibility of bankruptcy, which jeopardizes their ability to pay the insurance. In fact, bankruptcy can be viewed in part as a way in which firms annul their explicit or implicit contract to provide insurance against bad states of nature.

Employers also may find it hard to diversify against the high degree of systematic or non-diversifiable risk associated with cyclical unemployment. When times are tough, they are usually tough all over. This is in contrast to the risk associated with declining sectors, which may be spread by means of diversified product lines. For example, firms that can provide job security because they engage in a diversified portfolio of activities can pay lower wages; again, the insurance premium is paid by workers through the wage mechanism. Nevertheless, even here the lack of skill substitutability may make it difficult for firms to provide job security across a variety of activities that may not utilize the same skills.

For these reasons, private markets to provide insurance against the risk of being unemployed may not readily emerge. This is certainly the case with respect to conventional private insurance companies and, to a lesser extent, with respect to employers providing unemployment insurance to their own employees, although such employers can and do exist to a significant degree. In the absence of fully developed insurance markets, there may be a role for state-supported unemployment insurance, especially since the risk can be diversified somewhat across employers and employees, across regions, and even over time.

It should be realized, however, that the state faces many of the same problems as are found in private insurance markets. Specifically, the Canadian unemployment insurance program is poorly experience-rated, and workers with the highest probability of being unemployed pay the lowest premium (Kesselman, 1983). This can lead to workers and firms taking fewer precautions against the risk of unemployment than they would if the premiums were more experience-rated. For example, workers may engage in a longer job search or be less willing to engage in concession bargaining, and firms may have less incentive to avoid layoffs or to smooth out seasonal fluctuations. More experience-rating could mitigate this problem, but at the expense of abrogating the insurance function; it could also have equity implications, since persons with a higher risk of unemployment (who often tend to be lower paid workers) would pay the higher premiums. As is so often the case, a tradeoff between efficiency (reducing excessive unemployment) and equity (putting the highest premiums on those with the greatest ability to pay) is involved.

Equity Failures

The previous discussion referred to possible market failures with respect to the efficient allocation of resources when permanent layoffs are involved. Even if there were no failures or imperfections, so that such layoffs were a part of the normal efficient functioning of markets, the market would fail to take into account the equity implications of such layoffs (i.e., their fairness or distributional consequences). Perfectly functioning markets guarantee efficiency but not equity; in fact, dynamically adjusting markets are likely to have severe equity consequences because the adjustment process is likely to leave a large number of losers as well as gainers. Movements toward efficiency provide the potential to make everyone better off, but there is no guarantee that everyone actually will be made better off, in which case changes have to be judged on the basis of equity as well as efficiency.

Moreover, it is not always possible to separate efficiency and equity implications easily and completely (Gunderson, 1984). It is certainly possible to imagine a society that collectively prefers a smaller pie equitably distributed to one that is larger but unequally distributed, or that requires redistribution processes that are demeaning or stigmatizing and have their own adverse effects on the incentive to work and save, or that make people relatively worse off even though they are better off in absolute terms. In addition, losers may effectively block efficient changes if they are not compensated for their losses, especially if they can form effective coalitions, as is likely to be the case with mass terminations and plant closures.

Such possibilities suggest that even from a purely economic perspective it is certainly legitimate to consider equity and distributional aspects. The market itself does not do so because of the public-goods nature of redistribution (i.e., the benefits are equally available and the market does not automatically extract payment). The distributional consequences are internalized only insofar as firms that treat their employees fairly are likely to benefit from the reputation associated with such benevolence. However, this is not likely to help much when they are laying workers off, rather than hiring.

In circumstances where workers are guaranteed a degree of fairness and compensation they are less likely to resist efficient changes associated with such factors as technological change, deregulation or import competition. This suggests that compensation policies (e.g., mobility and retraining allowances) directed toward encouraging an efficient change are more likely to achieve both equity and efficiency objectives. This is in contrast to policies that discourage the change and which, by postponing the inevitable, may perhaps increase the magnitude of the ultimate change.

The Role of Unions and Collective Bargaining

In an economy where almost 40 percent of the work force is unionized and over 50 percent covered by collective agreements, the role of unions and collective bargaining must also be considered as a mechanism for dealing with permanent layoffs. By fixing wages above the competitive norm, by not engaging in concession bargaining, and by discouraging quits, hours reductions and discharges (Medoff, 1979; Freeman, 1980), unions may be exacerbating the problem of permanent layoffs; however, they are also an important institutional arrangement for handling some of the problems associated with layoffs and dismissals.

Collective Voice and Union Preferences

We usually think of unions as creating high wages for their members largely through collective bargaining and the threat of strike. However, causality may also work the other way. That is, some firms may be high-wage firms for other reasons (e.g., to reduce turnover, to ensure a waiting list of applicants, to encourage loyalty). In such circumstances, workers may be reluctant to leave because of the high wages. Given that they know they want to remain where they are, they may turn to collective action to have more say in their everyday work environment and to ensure due process at the workplace.

In the terminology used by Hirschman (1970), the reduction of "exit" (i.e., the reluctance of workers to leave because of high wages) increases the use of "voice" as a mechanism to achieve objectives. This is in contrast to the market mechanism, which relies on "exit" or the threat of exit for workers to achieve these objectives. Unions can be thought of as the institutional embodiment of Hirschman's collective voice mechanism (Freeman, 1976). This is consistent with the industrial relations perspective of unions as being at least as important in ensuring due process in the workplace as in obtaining wage gains.

As a voice mechanism, unions will represent their voting constituency subject to certain ideological constraints and, perhaps, minority rights. As such a political institution, unions will represent the preferences of their median or representative voters, especially those who can tip the scales in elections. This is in contrast to the market mechanism, which responds to the preferences of marginal workers (i.e., workers at the margin of decision) with their threat of exit. In contrast to marginal workers, who are likely to be younger, mobile, and not strongly attached to the firm or work force, median voters are likely to represent the majority of workers and be older, less mobile, and attached to the firm and community. They are the incumbent workers who may be receiving rents, in the sense that their salaries reflect what the firm has to pay to

attract and retain the more mobile marginal worker, yet their alternatives are diminished. Protecting such rents will make them even more interested in having the unions reflect their collective preferences.

This explains, at least in part, why unions emphasize seniority,[10] which protects the older incumbent workers, and why they fight wage cuts even if that means layoffs. Such layoffs are likely to fall on the younger marginal workers, who are less likely to exert crucial political pressure and more likely to be mobile and have alternatives. When the possible layoffs threaten the jobs of the representative median voters, then concession bargaining and a willingness to engage in work sharing become more likely. The union representation of incumbent, long-standing workers is also likely to correspond to a sense of justice, since such workers are likely to have acquired considerable fixities in their job (e.g., home, children in school, and a stake in the community).

Potential for Dealing with Problems

By being a collective-voice institution, unions are in a good position to deal with many of the problems associated with permanent layoffs. Like other factors in the work environment, issues pertaining to layoffs can be subjected to internal union tradeoffs and bargained for according to such collective preferences. Unions are able to *ascertain* those preferences on the part of their members, *articulate* them to management both at the bargaining table and during the administration of the collective agreement, and then *monitor* the consequences.

Of course, problems connected with minority rights and the tyranny of the majority may arise; however, these are problems that touch all political institutions that rely on democratic voting mechanisms. To a certain extent they are mitigated by the fact that antidiscrimination legislation and minimum employment standards legislation take precedence over collective agreements, and thus prevent certain basic issues from being bargainable. In addition, the social conscience of many voters, including union members, mitigate against totally opportunistic behaviour.

Unions not only have the ability and the power to deal with issues directly in the workplace; they can also be an effective force in the political arena, pressuring for legislative changes to improve conditions for union and non-union workers. Such lobbying is consistent with their own interests, because whatever can be gained in the legislative arena reduces the need to surrender anything in the course of collective bargaining for those ends. Moreover, protection for non-union workers is not only consistent with a sense of social justice; it also reduces the need to compete with a lower cost non-union sector.

Mechanisms for Dealing with Problems

Apart from activity in the legislative arena, the main mechanisms that unions have for dealing with problems such as layoffs and dismissals are collective agreements, grievance procedures, and consultation — for example, through joint committees. Joint union-management relations committees do not appear to be a prominent mechanism for dealing with such issues, partly because layoffs are generally regarded as a management prerogative, subject to minimal procedural or legislative constraints. As indicated by Carrothers (Canada, 1979, p. 104): "Joint consultation . . . presumes a degree of acceptance by management, not commonly found in Canadian industrial relations at the enterprise level, of the labour union's potential contribution."

As well as the use of seniority, the collective agreement can and does deal with such issues as advance notice, severance pay, and supplementary unemployment benefits (the extent of which will be discussed subsequently) as they pertain to layoffs. In most circumstances, however, layoffs and dismissals are the prerogative of management, subject to the previously mentioned provisions and the requirement that dismissals for reasons other than economic redundancy be for just cause (e.g., repeated negligence, drunkenness, insolence). The grievance procedure[11] is often involved with the interpretation of just cause, with reinstatement, often with back pay, being the usual remedy for unjust dismissals.

Provisions in Collective Agreements

Table 4-4 indicates the proportion of major collective agreements in Canada that have certain provisions such as advance notice, severance pay, and supplementary unemployment benefits designed to deal with layoffs.[12] Slightly more than half the collective agreements incorporate advance notice requirements, and many of these require only one week's notice or less. Although the proportion of collective agreements requiring more than one week's notice grew over the period, by 1982 it was still only one-third of all agreements. Similarly, the proportion that includes severance pay increased over time, but by 1982 only 44 percent had severance pay. An additional 7 percent had severance pay and supplementary unemployment insurance benefits, which, either by themselves or along with severance pay, were relatively rare. The majority of employees with severance pay were in places giving one week of pay for every year of service up to a maximum of 21 to 30 weeks' severance pay.

In essence, collective agreements do not seem to provide a major source of protection for workers who have been laid off.[13] Only about one-third of employees are covered by plans giving advance notice of one week or more and about half have severance pay, typically one week

TABLE 4-4 Layoff Provisions in Major Collective Agreements, Canada (Proportion of Employees Covered by Provisions)

Provision	1973	1974	1976	1977	1979	1980	1981	1982
				(percent)				
Notice of Layoff								
1 week or less	22.1	24.1	22.2	21.6	19.3	24.9	22.8	22.9
Other	27.9	24.9	24.5	27.1	28.9	26.4	31.0	33.5
No provision	49.9	51.0	53.3	51.3	51.8	48.7	46.2	43.7
Severance Pay								
Benefits specified	33.7	32.0	31.5	41.0	44.8	46.4	46.1	44.0
Pay with supplementary unemployment benefits	10.0	10.8	8.6	8.7	10.8	10.4	7.2	7.0
No provision	56.2	52.8	59.9	50.3	44.3	43.2	38.3	40.3
Supplementary Unemployment Benefits								
Provisions	3.4	3.4	3.7	3.2	3.0	3.7	7.7	7.9
Supplementary unemployment benefits with severance pay	0.0	10.8	8.6	8.7	10.8	10.4	7.2	7.0
No provision	86.6	n.a.	87.7	88.0	86.1	85.9	84.6	84.5

Source: W.D. Wood and P. Kumar, eds., *The Current Industrial Relations Scene in Canada* (Kingston: Queen's University, Industrial Relations Centre), various issues.

Notes: Depending upon the year, major collective agreements refers to those covering 200 or more or 500 or more employees. In more recent years the coverage is for 200 or more employees.

Figures may not sum to 100 percent because of the omission of a small number of employees in other categories.

Data for 1975 and 1978 were not compiled in the original data sources. The figures should be regarded as approximations for the years since different months were often involved.

of severance pay for every year of service up to a maximum of about one-half a year's pay.

Reasons for Downplaying Protection

Reasons for this relative downplaying of protection from layoffs in collective agreements are not obvious. Carrothers (Canada, 1979, pp. 231, 253) asserts that "The resolution of redundancy problems does not lend itself ideally to the adversary system found in the collective bargaining relationship" and that "A clear recognition by all parties of the fundamentally different character of redundancy management from conventional collective bargaining is a first step."

It may also be that redundancy protection simply comes at too high a price in terms of other elements that must be given up in the collective bargaining process. (Examples of such "givebacks" with respect to plant closure considerations are discussed in Kovach and Millspaugh,

1983.) Employers may be unwilling to give up their managerial prerogative in this area without significant concessions elsewhere, and unions may be unwilling to make those concessions. Unions may be willing to leave layoffs largely in the hands of employers because layoffs can also be costly to employers (e.g., a loss of firm-specific human capital) and hence may not be abused; this is in contrast to wage concessions, which would benefit employers and involve few appreciable costs. Even in declining industries, unions may not opt for wage concessions because they know that the firm is unlikely to replace them with the new capital since the industry is in a state of decline where new capital formation is not merited. In essence, the union may exploit the inelasticity of demand for its labour created by the declining capital stock.

As mentioned previously, the union preference for wage over employment protection may also reflect the voting preferences of older union members whose jobs are secure, and the fact that some of the consequences of layoffs are born by public programs such as unemployment insurance. Seniority provisions, which are pervasive in collective agreements, give older workers a degree of protection against layoffs and may in fact shift the risk of layoff onto younger workers who are at an age when they can better absorb that risk. However, the severity of the recent recession may have changed this perception of security, even for older workers, especially when plant closures are a possibility. This can give rise to such phenomena as concession bargaining and a willingness to engage in work sharing.

As shown subsequently, collective agreements may not provide much protection from permanent layoffs either, because of legislative provisions with respect to requirements for at least some advance notice in most jurisdictions, and severance pay in many.

Legislation and the Courts

Legislative initiatives in the employment relationship seem to exist, in part, in response to perceived failures of private market arrangements (often termed "private ordering" in legal parlance) as well as collective arrangements such as collective bargaining.[14] The role of legislation can vary from simply providing the legal framework within which private market and collective bargaining contractual arrangements can be made, to providing a safety net or minimal floor of protection, especially for those who are not adequately protected by private market or collective bargaining arrangements, to providing a leadership role to be subsequently emulated by private market and collective bargaining relationships.

Whatever the role of legislative initiatives, such intervention has taken a variety of forms. In addition to the labour relations laws, which

sanctify collective bargaining arrangements and the arbitral jurisprudence associated with those arrangements, legal initiatives in the arena of employment termination have taken the form of employment standards legislation as well as common law jurisprudence through the courts. The main areas of legal initiatives relating to employment terminations deal with advance notice, severance pay, wage claims resulting from bankruptcy, and issues over wrongful or unjust dismissals. The purpose of this section is to outline Canadian legal initiatives in these areas, to contrast them with some foreign experiences, and to discuss their effects.

Advance Notice of Permanent Terminations

Table 4-5 presents the requirements for advance notice in various Canadian jurisdictions as of 1984, for individual and for mass terminations. While there is considerable variation, with some (New Brunswick, the Northwest Territories and the Yukon) having no advance notice requirements, most have such requirements, usually after three months of service (typically giving one week's advance notice), with a sliding scale requiring approximately one week of notice for each year of service, usually to a maximum of eight weeks' notice. Some jurisdictions require roughly the same notice from employees, with a maximum of two weeks' notice.

With respect to mass terminations, British Columbia, Prince Edward Island and Saskatchewan have no special provisions, and those jurisdictions that have no individual notice also have no provisions for mass terminations. However, the remaining jurisdictions do have special notice requirements for mass terminations, with the requirements typically being 8, 12 and 16 weeks corresponding to small, medium and large mass layoffs. What constitutes small, medium and large depends upon the province.

As indicated in the *Industrial Relations Research Report* (1980), advance notice is not required for employees who are laid off on a temporary basis (i.e., subject to recall within 13 weeks). In those jurisdictions with advance notice requirements, the equivalent termination pay in lieu of notice can be made (except in Quebec, where no such provision exists).

Severance Pay[15]

In addition to the advance notice requirements (or termination pay in lieu of notice), severance pay is required by law in only two jurisdictions in Canada, and in these only since the 1980s. In the federal jurisdiction, 12 months of continuous employment is required for eligibility, and entitlements are two days' wages for each completed year of employ-

TABLE 4-5 Notice Requirements for Termination of Employment, Various Jurisdictions, Canada 1984

	Individual Termination			Mass Terminations	
Jurisdiction	Length of Service	Employer Notice (wks)	Employee Notice (wks)	Employees	Notice (wks)
Federal	3 mos	2	none	50+	16
Alberta	3 mos–2 yrs	1	none	no special legislation	
	2 yrs+	2			
British Columbia	6 mos–2 yrs	2			
	2 yrs+	a	none	no special legislation	
Manitoba	not applicable	1 pay period[b]	same	50–100	8
				101–300	12
				300+	16
New Brunswick		no notice provisions			
Newfoundland	1 mo–2 yrs	1		50–199	8
	2 yrs+	2		200–499	12
				500+	16
Nova Scotia	3 mos–2 yrs	1	1	10–99	8
	2 yrs–5 yrs	2	2	100–299	12
	5 yrs–10 yrs	4	2	300+	16
	10 yrs+	8	2		
Ontario	3 mos–2 yrs	1	1	50–199	8
	2 yrs–5 yrs	2	2	200–499	12
	5 yrs–10 yrs	4	2	500+	16[d]
	10 yrs+	8	2[c]		

Prince Edward Island	3 mos+	1	same	no special legislation	
Quebec	3 mos–1 yr	1		10–99	8
	1 yr–5 yrs	2		100–299	12
	5 yrs–10 yrs	4	e	300+	16
	10 yrs+	8			
Saskatchewan	3 mos–1 yr	1			
	1 yr–3 yrs	2			
	3 yrs–5 yrs	4	none	no special legislation	
	5 yrs–10 yrs	6			
	10 yrs+	8			
Northwest Territories		no notice provisions			
Yukon		no notice provisions			

Source: Extracted from *Canadian Labour Law Reporter* (1984), pp. 941–54.

a. One week per year, to a maximum of 8 weeks.

b. Where wages are paid once a month or more often. If wages are paid less frequently than once a month then "reasonable notice" is required.

c. For any length of service in Ontario, employee notice is required only where notice has been given by employer.

d. If the terminated employees comprise 10 percent or less of the employees in the establishment, the individual notice provisions apply, unless the termination is caused by the permanent discontinuation of all or part of the business.

e. In the Civil Code, for domestics, servants, labourers and journeymen: 1 week's notice if hired by week; 2 weeks' if hired by month; 1 month's if hired by year (same for employer or master).

ment with a minimum of five days' wages. Workers are not eligible if dismissed for just cause, if entitled to a pension, or if the layoff resulted from a strike or lockout.

In Ontario, severance pay is required for employees (except in the construction industry) with five or more years of service and where 50 or more employees are terminated in a period of six months or less. Severance pay amounts to one week's pay for each year of employment up to a maximum of 26 weeks. Payment does not apply where the employee refuses a reasonable offer of alternative employment, refuses to exercise a seniority right, refuses to waive the right to recall, or retires and receives an actuarially reduced pension. However, part-time employees are covered, as are employees terminated because of a strike or lockout, and employees ousted by another employee exercising a right of seniority.

British Columbia requires severance pay equal to the last eight weeks' pay. However, this is required only if advance notice has not been given and is therefore really pay in lieu of notice (a provision that exists in all jurisdictions with advance notice requirements) rather than severance pay in addition to the advance notice requirement.

Wrongful and Unjust Dismissal

As discussed previously, in the unionized setting employers can terminate redundant employees for economic reasons (subject to notice, seniority, severance pay, or any other negotiated provision); however, for other reasons the employer can dismiss an employee only for just cause (e.g., failure to obey a reasonable order, repeated insolence, drunkenness, or morally improper behaviour). Employees may appeal the discharge through the normal grievance procedure, and may be reinstated and possibly compensated.

In the non-union setting there are two potential avenues for employees to seek redress in the case of being terminated or dismissed: wrongful dismissal proceedings through the courts, under common law, and in some jurisdictions unjust dismissal proceedings through statutory employment standards provisions. (The terms wrongful and unjust dismissal are often used interchangeably.)

Under common law, the courts have been faced with increasing numbers of cases of wrongful dismissal arising from the unlawful termination of the contract of employment, written or otherwise, usually on the grounds that no reasonable notice has been given (Saxe, 1981, p. 18). Under common law, reasonable notice must be given in cases of dismissal for redundancy (e.g., economic reasons), but not for just cause.

In individual cases, the determination of a reasonable notice period is subject to interpretation and, hence, is determined on a case-by-case basis (Glasbeek, 1982, p. 69; *Canadian Labour Law Reporter*, 1984, p.

944). A typical rule of thumb may be the person's pay period; however, this may be modified for such factors as the difficulty of finding other employment and the person's status in the company, with the courts interpreting reasonable notice to be much greater for higher- than for lower- level personnel (Adell, 1981, p. 82; Glasbeek, 1982, p. 69).

In response to the increasing number of terminations at all levels as the economy has gone through prolonged recessions and substantial adjustments, cases of wrongful dismissal have increased in recent years (Christie, 1983, p. 6; Saxe, 1981, p. 18). As indicated in Harris (1980, p. 1): "Prevailing economic conditions, together with corporate mergers, reorganizations . . . and rapid market and technological changes demanding new personnel, have placed greater uncertainty upon security of tenure, once a cherished value of all middle and senior management personnel. The absence of troublesome union grievance procedures, and generally of any written contracts of employment, make high incomes of such personnel vulnerable to cost-cutting forces."

As the quote implies, the wrongful dismissal procedure through the courts is resorted to mainly by executive and managerial personnel. This is so both because of the expense involved and because what the courts have considered reasonable notice is much greater for higher-level personnel. One informal estimate has placed the number of terminations in Canada each year at approximately 250,000, with 15 to 20 percent of these being contested with legal representation, or by self-representation.[16]

In part because costly and lengthy legal proceedings limit wrongful dismissal procedures under common law to higher income personnel, a number of jurisdictions have followed the statutory procedure of providing for unjust dismissal procedures under their relevant employment standards law. The adjudicated procedure basically follows that of the grievance procedure for unjust dismissals under collective bargaining, and is based on interpretation of what constitutes unjust dismissal, with termination of redundant employees for economic reasons being legitimate. Redress usually comes in the form of reinstatement, perhaps with back pay.

As of 1984, statutory unjust dismissal procedures existed only in the federal jurisdiction, Quebec and Nova Scotia (*Canadian Labour Law Reporter*, 1984, pp. 957–58). Where such regulations exist, the usual procedure is first to try unjust dismissal procedures under the relevant employment standards statute (since it entails no cost) and then possibly to resort to the more costly wrongful dismissal procedure through the courts (and possibly to a human rights commission, if the dismissal is discriminatory).

This discussion highlights a number of differences between wrongful dismissal dealt with through the courts, and unjust dismissal dealt with through employment standards. Wrongful dismissal can lead to reim-

bursement, including compensation for stress and other non-economic factors; it can be carried through by managerial personnel who may be excluded from coverage under the standards; it can be an expensive and lengthy procedure; it can be based on failure to give reasonable notice to redundant personnel; and for many of these reasons it is used mainly by higher-level personnel. In contrast, unjust dismissal through employment standards leads only to reinstatement, with possible back pay; managerial personnel are often excluded from coverage; and it is based only on the interpretation of just cause (reasonable notice being part of the advance notice requirements of the statute).

An evaluation of the success of reinstatements from unjust dismissals is beyond the scope of this analysis.[17] For our purpose, the main point is that employees have turned increasingly to the courts and to statutory protection against termination. This likely reflects both the increase in the number of terminations and the fact that the lack of job opportunities elsewhere makes termination more costly to individual employees. Existing jobs become more important when there are no others.

Wage Claims under Bankruptcy

Bankruptcy poses a particular problem for the compensation of employees because it is often unanticipated (employers rationally hiding their problems for fear of alienating creditors, dealers, customers and workers) and because employees are often in a difficult position to absorb the losses, in part because of the problem of diversifying their human capital across a number of firms. This is in contrast to shareholders, creditors and suppliers, who can diversify across firms and who are often in the business of such risk-taking.

Issues of bankruptcy and insolvency are largely under federal jurisdiction, although issues pertaining to receivership (where the business continues under a receiver) and informal voluntary business wind-ups (usually of small retail operations) have mostly been dealt with by the provinces, largely through default (Butler and McCabe, 1982, p. 1). There appears to be considerable uncertainty, however, about the jurisdictional rights of provinces in such matters.

Currently, under the federal Bankruptcy Act, creditors are divided into four classes, with wage claims up to a maximum of $500 ranking fourth within the second class of creditors, albeit all creditors are subordinate to federal and provincial Crown deemed trusts, which businesses must set for sales tax, employee income taxes and government pensions. After these disbursements the classes of creditors, in order of priority, are (Butler and McCabe, 1982):

- Secured creditors: mortgages, with mortgage on business's real estate and physical assets; holders of floating charges secured on operating capital.

- Preferred unsecured creditors: funeral expenses; administration costs; superintendent's levy; wage claims, maximum \$500; three months' rent arrears; UIC and workers' compensation holdings.
- Ordinary unsecured creditors: for example, suppliers of materials and service.
- Deferred creditors.

The \$500 maximum, an amount that has been established since 1949, is often regarded as too low, especially since prior claims often exhaust the estate before wage claims are met. In part for this reason, a number of committees and proposed bills have recommended such changes as an increase in the maximum to \$1,000 (in 1970), \$2,000 (in 1978), and an absolute priority over all other creditors (in 1975), as well as a government fund for unpaid wages (Canada, 1981, pp. 3–5).

In addition to the federal Bankruptcy Act there are a number of federal statutes that offer limited protection for wage claims, often to specific employees such as seamen, federal contractors and bank employees. As well, there are more than 100 pieces of provincial legislation with provisions for wage protection (ranging from the posting of bonds, to mechanics' liens, to statutory priorities, to wage protection funds) which usually allow higher wage claims, ranging from \$1,000 to \$5,000. At present there is considerable debate over the constitutional validity of provincial initiatives in such wage protection matters.

Unfortunately, systematic data on the extent of unpaid wage claims under insolvencies are not available. Based on a survey of business bankruptcies, Butler and McCabe (1982, p. 12) and Canada (1981, p. 30) indicate that between 1976 and 1980 wage claims were made in only 9.3 percent of bankruptcy cases, with only about 2,000 employees per year submitting wage claims, averaging approximately \$900 per claim, with average payments being \$200 and losses \$700. They estimate that this represents only about 20 to 50 percent of unpaid wages claimable under the Bankruptcy Act, with wage losses outside the Bankruptcy Act being unknown, as are losses of fringe benefits such as severance pay and unfunded pension payments.

Given the problem (albeit of an unknown dimension) associated with unpaid wage and fringe benefit claims under bankruptcy, the two main policy options to increase the speed and likelihood of wage recovery are the reordering of the priority of wage claims amongst the creditors, and the creation of an independent source of funds for wage claims. The source of funds could be private bonding or insurance arrangements, consolidated tax revenues, or a wage protection fund from employee and employer contributions. The wage protection fund financed from employer contributions is the trend in Europe.

Surprisingly, there has been little theoretical or analytical work on the ultimate consequences of these different policy options. Presumably, the optimal ordering of creditor priorities reflects some combination of such

factors as minimizing strategic behaviour and transactions and monitoring costs, placing risk where it can best be minimized or diversified, and maximizing the possibility of continuing the operation as a going concern if it is economically viable. Equally important, the existing creditors have charged risk premiums (including compensating wages) according to their known priority in the ranking of creditors; changing that priority through fiat will create windfall gains and losses at least for the life of the particular contract. Prices (i.e., wages) will also adjust if employers are taxed to pay for a wage protection fund, since the compensating wage premium they have to pay for the risk of wage losses is reduced. In the end, workers will pay the cost, in part at least, for the benefit they receive from such wage protection; the ultimate incidence of a tax is often different from where it is levied.

Increasing the priority of wage claims under bankruptcy will set off some of the following subtle adjustment processes. The compensating wage premium associated with the risk of wage loss will fall, and the compensating price (e.g., interest rate or terms of credit) for those of lower priority will rise, reflecting their greater risk. Workers will be less prone to engage in concession bargaining to reduce the risk of bankruptcy because their claims are more secure and they will have less need to arrange for private insurance arrangements, including private savings. In addition, workers will be more willing to accept deferred compensation in the form of fringe benefits such as pensions and severance pay, to the extent that they are now more secure. This is not meant to be an exhaustive list of the subtle adjustments that will occur in response to changing the priority of wage claims under bankruptcy; rather, it is meant to illustrate the changes that will occur in the long run.

Foreign Comparisons

Critics of Canadian legislative initiatives in the area of employee terminations tend to point to European initiatives that they feel should be emulated. The ten member states[18] of the European Economic Community (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, and the United Kingdom) have adopted directives on collective dismissals (1975), the safeguarding of worker rights in the event of a transfer of the undertaking (1977), and worker protection in the case of insolvencies (1980). The directives set only minimum standards for the member states to follow (*European Industrial Relations Review*, 1980, p. 11), and they are legally binding on the member states (Bureau of National Affairs, 1983, p. E-1).

Collective dismissals occur for reasons not attributable to the workers themselves, usually because they become redundant for economic reasons. The directive itself sets the number of workers involved as 20 or more over a 90-day period, or where, over a 30-day period, at least 10

workers (in firms with 20–99 workers), 10 percent of the work force (in firms of 100–299 workers), or 30 workers (in firms of 300 or more) are made redundant. However, the separate states often have lower numbers, down to two in France and any number in the United Kingdom.

The procedures usually involve advance notification, consultation and often negotiation with employees as well as the community, and varying amounts of severance pay and compensation. Information must be provided on such factors as the reasons for the dismissals, the occupational groups affected, and the timing of the dismissals. A period of consultation and/or negotiation is usually required to allow time to seek ways of avoiding or mitigating the consequences of the proposed dismissals. Prior notification to the appropriate labour office (usually 30 days in advance) is also required; in France, permission is actually required before any collective dismissal is put into effect.

The compensation arrangements are more varied, with Belgium being the only country requiring a specific level of compensation, equal to half the difference between previous earnings and unemployment benefits. In West Germany, severance pay may be part of a social plan that must be negotiated prior to the collective dismissal. In France, Ireland and the United Kingdom, severance pay under collective dismissals is the same as for individual dismissals arising from redundancies that occur on economic grounds. In Denmark, Greece, Luxembourg and the Netherlands, compensation under collective dismissals is the same as for any dismissal situation (with no special severance pay for economic dismissals resulting from redundance); this usually amounts only to pay in lieu of notice and for unused holidays.

In most European countries similar notification and consultation arrangements also apply to insolvency situations. Through a central, state-run fund, workers are also guaranteed payment of amounts owed to them by their employers. The fund is reimbursed in part because it is frequently a preferred creditor with respect to claims on the employer's assets. The scope of the guarantee varies considerably: in France it covers all outstanding payments, in Italy it covers only severance pay.

In addition to the directives on collective dismissals and on insolvencies, in 1977 a directive was passed on safeguarding employee rights in the event of the transfer of undertakings through acquisition, mergers and takeovers. Basically, the directive requires employers to inform and consult with employees in advance of the proceedings, and deems that change in ownership does not constitute grounds for dismissal (Bureau of National Affairs, 1983, p. E-2).

The European requirements with respect to terminations could be regarded as largely token, involving mainly notification (which usually exists in Canada) and consultation, with few requirements against terminations or for direct substantial compensation. Nevertheless, the process itself appears to involve more than simply going through the

motions. It can deter employers from terminating employees and having to go through costly and time-consuming procedures; it may provide information that can alter decisions or at least make them more understandable; it involves workers and the community in the process and not just the outcome of decisions (this in turn can foster mutual understanding); and it subjects the termination decision to political and community as well as conventional economic pressures.

With respect to Japan, Hanami (1982, p. 183) indicates that "by comparison with the recent trend in Europe in policies or measures to cope with workforce reductions, the Japanese system is characterized by a lack of positive restrictions on dismissal and other measures used by management for the purpose of workforce reduction. It aims to alleviate the impact of the dismissals on the workers but does not interfere with the decision-making of management on workforce reductions." This deemphasis on overall legislative initiatives has been associated with individual actions against wrongful dismissals through the courts (p. 183). The lack of legislative initiatives in Japan may be attributed, in part at least, to their policy of lifetime employment in the larger organizations — a policy that minimizes permanent layoffs through such alternatives as the non-renewal of temporary workers, temporary layoffs with part pay, transfers to other parts of the organization, or induced voluntary departures (Yemin, 1982, p. 5; Gordon, 1982, p. 35).

Also in contrast to Europe, "In the United States there is no universally applicable statutory provision concerning individual or collective dismissals at either the federal or state levels. The whole area of hiring and firing is entirely left to the relationship between the employer and the employee, be it in the form of an individual employment contract or one collectively reached" (Canada, 1979, p. 122). The Carrothers report also indicated that "Canada remains more philosophically identified with the United States redundancy policy than with others. . . . Apart from "notice" and modest rates of severance pay there is no general requirement concerning redundancy management codified in Canadian legislation" (p. 122). The Carrothers Commission concluded their review of foreign redundancy policy with the following assessment: "In all the countries of Western Europe, including the United Kingdom, redundancy management is a more highly structured process than in Canada. The United States is notable for the almost total absence of public redundancy policy" (p. 183).

Impact of Legislated Initiatives

The impact of various legislated initiatives with respect to terminations can be evaluated from a number of perspectives. Stiebert (1973), for example, finds that over 70 percent of employees in Ontario who lost their jobs as a result of mass terminations made use of the advance notice

period to look for work. Based on the same data, McKenna (1973, p. 2) found that of the persons who left their employment, approximately 47 percent had found a job in the subsequent two- to nine-month period, and that success was greater for persons who used the notice period to seek new employment. Based on U.S. data, Folbre, Leighton, and Roderick (1984) also found that advance notification significantly lowered the unemployment resulting from a plant closure, and Weber and Taylor (1963) found that advance notice did not lead to a higher number of voluntary quits or lower productivity.

In contrast, based on British data, MacKay and Reid (1972, p. 1260) found that the length of notice did not reduce the length of subsequent unemployment. The regulatory costs and the effect on business decisions have also been emphasized in McKenzie (1982).

The most interesting question, however, pertains to the effect on overall unemployment of legislation which raises the cost of terminations. This applies regardless of whether the cost of termination is raised through notice requirements, consultation, severance pay, or court costs in wrongful dismissal cases. Obviously, raising the cost of an activity, including permanent layoffs, should reduce the use of that particular activity. Firms may substitute capital for labour and use other procedures for layoffs: internal transfers; retaining redundant workers; voluntary buyouts, including golden handshakes for early retirement; diversifying and planning portfolios of production activities to reduce the need for permanent layoffs; and, in the case of multinationals, perhaps cutting back in other areas where the termination costs are lower. All these alternatives may be costly; however, they may become more attractive economically if the cost of permanent layoffs is increased. In many circumstances these may be alternative procedures that public policy may prefer to encourage so as to reduce the numbers of permanent layoffs, if for no other reason than to save on the public transfer payments that may otherwise result from the layoffs.

In some circumstances, however, the adjustments may create other problems, including longer-term unemployment problems. While raising the cost of terminations induces a move away from the use of termination as a policy to deal with redundancy, it also has an output effect; the cost increase may compel firms to reduce their output and associated labour inputs. This may be accomplished by reducing the rate of new hiring or plant expansion, or by increasing the flow of temporary layoffs by recycling workers through a series of bouts of temporary unemployment.

Once termination costs become anticipated they become quasi-fixed costs in the hiring decision; that is, the cost of hiring new workers becomes not only the recruiting and training costs but also the expected termination costs. These are fixed once the worker is hired, but they can be avoided by not hiring the worker. In that sense they are akin to start-

up costs and not sunk costs; they can be avoided by not starting-up, in this case by not hiring workers who may ultimately be associated with termination costs. Firms may be reluctant to hire people for permanent positions, given the possible termination costs. This could lead to more "contractually limited" positions, as well as to contracting out.[19] It may also lead to decisions to locate where the expected termination costs are smaller, raising the concerns of particular jurisdictions that such employment protection costs may discourage firms from locating in their jurisdiction (Yerbury and Clark, 1983, p. 354).

Given the possibility that increasing termination costs can reduce both terminations and hiring, the effect of such legislative initiatives is ultimately an empirical proposition. Nickell (1979) econometrically tests for the impact of British legislation lengthening the notice period and requiring severance pay. He found that the numbers of both dismissals and new hirings did fall, but that the latter outweighed the former, so that in fact there was a net increase in unemployment. Employment protection legislation, which makes it difficult to fire redundant employees, has also been found to reduce the demand for new hirees, and hence to increase unemployment in the United Kingdom (Andrews and Nickell, 1982) and France (Malinvaud, 1984).

It is worth noting, however, that the ability of firms to locate in different jurisdictions in Canada could make the reduction in new hiring a real possibility if only one or a few jurisdictions increased the termination costs. In addition, however, the openness of the economy and the flexibility of multinationals also means that a more nationally uniform policy (to prevent such regional competition) may concentrate new hiring in other countries.[20] The cost consequences become difficult to avoid and hence the real questions become: Are they worth the benefits, and is the preservation of some existing jobs worth the possible loss of other new jobs?

This also highlights the fact that policy initiatives to help incumbent workers who would otherwise be terminated may reduce employment opportunities for potential new workers who may otherwise have been hired, and the latter may include youth and female reentrants — two groups that already have labour market problems. Vesting job property rights in one group may reduce the opportunities of others when jobs are scarce. Of course, when economic conditions are more buoyant, many of these concerns dissipate.

While an overall assessment of the full impact of initiatives to reduce permanent layoffs is beyond the scope of this paper, some observations can be made. Especially in Europe, where legislative initiatives in this area appear to be greatest, there is growing concern over the payroll taxes used to finance the social security system, as well as the effect of higher labour costs on the international competitiveness of some of the older industries such as iron and steel and shipbuilding. It appears that

employment protection legislation has inhibited the market mechanism in Europe and that, by reducing the rate of new hiring, such legislation has contributed to overall unemployment. However, there is no consensus on the relative importance of this factor. As stated by Ellman (1984, p. 13) in his assessment of the lesser importance of market forces in Europe as an explanation of their rising unemployment: "While employment protection legislation may explain a part of the current unemployment, it can scarcely explain its size and rapid growth."

Summary and Discussion

From the limited data available, it is clear that in recent years involuntary job losses are a large and growing component of unemployment. While most of these job losses are temporary, a large and ever-increasing number involve permanent separation from employers and the attendant adjustment consequences. These adjustment consequences include substantial income losses and spells of unemployment as well as socio-psychological effects on individuals and the decline of communities.

The Market

The market response to exogenous shocks that create the need for adjustment is basically to reallocate resources to their most valued use, leading possibly to permanent and involuntary layoffs. Beforehand, workers may receive a compensating wage associated with the risk of such a layoff; after, they may either gain or lose, depending upon whether the risk comes to fruition.

In its turn, the need to pay a compensating wage induces employers to adopt an efficient adjustment strategy. Depending upon their particular situation, this may involve some combination of the provision of stable employment, the retention of redundant workers, the use of marginal adjustments such as attrition, early retirement and work sharing, the provision of severance pay or voluntary buyouts, or simply laying off workers and accepting the higher compensating wage that may result from the need to recruit workers in such a risky environment. Workers in turn would sort themselves into jobs, in part on the basis of such employment characteristics, and they would adopt their own efficient strategies (e.g., diversification, private saving) to deal with the possible adjustment consequences. Even if the market does not work perfectly in this fashion, it is likely to exert pressure in the directions outlined.

A number of potential sources of market failure were identified as possibly frustrating the market mechanism from working in the direction set out above. Two areas where there is legitimate debate over the ability of the market to internalize the third-party external effects pertain to possible congestion externalities resulting from mass layoffs (as the

search time of the existing unemployed is adversely affected, given the limited capacity of the labour market to absorb the unemployed) and to the possibility that firms are reluctant to innovate policies that could reduce layoffs or their consequences because of an inability to appropriate full returns, in spite of the fact they would bear the costs of unsuccessful innovations. Other externalities were largely seen as transfer or pecuniary externalities working through the price system and, as such, are usually a sign that the market is functioning and not failing, albeit the distributional consequences could be severe.

Imperfect information may also prevail, given the public goods nature of information in the public domain and the fact that employers may rationally try to hide information pertaining to plant closures or bankruptcy. In addition, the compensating wage mechanism of private markets may be thwarted by wage fixing on the part of unions and legislation. Political pressures may induce multinationals to close what appear to be economically viable operations and keep open ones where the political costs of closure are higher. Political realities also mean that laid-off workers are going to receive public support in some form, in which case governments may support what appear to be inefficient adjustment measures (e.g., policies for firms to retain redundant workers) so as to avoid the other transfers.

Even if there were no market failures or imperfections with respect to permanent, involuntary layoffs, governments might intervene for reasons of equity in an attempt to share the market adjustment costs, the efficiency gains from allowing markets to adjust presumably providing the means for compensation. Such compensation may also be efficient to the extent that it reduces the resistance of workers to block market adjustments, the costs of which they otherwise may bear disproportionately. Following efficient market adjustments may provide the potential to make everyone better off; compensating the losers may be necessary to realize those gains.

Collective Bargaining

Being an institution of political voice, unions are likely to respond to the voting preferences of the average or typical union member, who is likely to be older and less mobile than the marginal worker whose threat of exit drives the market mechanism. Unions are also able to ascertain the preferences of their members, articulate them at the bargaining table and during the administration of the collective agreement, monitor the consequences, and bring pressure to bear at the political level.

Through the grievance procedure unions have contested dismissals that were not perceived to be for just cause or made according to seniority provisions. They have also bargained for advance notice, severance pay and supplementary unemployment benefits, although the

protection afforded by these provisions has been slight. This may reflect a combination of various factors: the voting preferences of their older workers (preferring seniority protection) as opposed to others who may be better able to absorb the layoff consequences, especially if supported by public programs; a reluctance to give up other concessions to gain a right jealously guarded by management; a knowledge that layoffs can also be costly to employers and hence may not be abused; and a belief that layoffs are the result of government economic mismanagement and hence should not be the subject of bargaining.

Legislation and the Courts

In part because of a real or perceived failure on the part of the labour market and collective bargaining to deal with problems associated with permanent, involuntary termination, a number of initiatives have been followed in the legislative arena and through the courts.

Advance notice of permanent terminations is required in the employment standards legislation of most Canadian jurisdictions, usually requiring one week's notice for each year of service and usually for a maximum of eight weeks' notice. Some also have special provisions for additional notice in the case of mass layoffs. Legislated severance pay is relatively new and required only in the federal jurisdiction (two days' pay per year of service) and Ontario (one week's pay per year of service) subject to certain restrictions and eligibility requirements. Employment standards legislation in the federal jurisdiction, Quebec and Nova Scotia also provides for adjudication of unjust dismissal procedures.

Under common law, the courts have increasingly been faced with wrongful dismissal cases, usually on the grounds that reasonable notice has not been given in the case of redundant personnel. This has mainly been carried through by higher income personnel, in part because of the expense involved, and in part because they are usually considered to require longer notice periods and hence can receive higher awards.

Issues pertaining to wage claims under bankruptcy are exceedingly complex because of the complicated jurisdictional question. Under the federal Bankruptcy Act, wage claims to a maximum of $500 are fourth in the category of preferred unsecured creditors, behind secured creditors, but ahead of unsecured and deferred creditors. In addition, there is a complicated array of federal and provincial statutes that can provide some additional protection; nevertheless, the protection is generally neither substantial nor secure. Raising the amount and priority of wage claims and creating a wage protection fund have been suggested as policy options; yet surprisingly little research or discussion has gone on about the possible effects of these policies on strategic behaviour, risk-taking and diversification, and risk premiums for creditors and workers.

Experience with legislative initiatives for worker protection in the

areas of collective dismissals, insolvencies, and the transfer of undertakings has generally been much more extensive in Europe than in Canada or the United States. The procedures generally involve notification, consultation, negotiation with employees and the community, and varying degrees of compensation. Wage protection funds also exist for wage claims under insolvencies. Japan has little formal legislative intervention; however, the need for this is reduced in part by the lifetime employment system.

Such legislative initiatives should reduce the number of involuntary terminations by increasing their cost to the firm. However, firms may also adjust by reducing their rate of new hiring to avoid the likely occurrence of such costs in the future, and some empirical evidence supports this proposition.

Discussion

While it is beyond the scope of this study to analyze the precise appropriate amount and form of legislative initiatives with respect to permanent layoffs, in the current period of public sector retrenchment and emphasis on deregulation and restraint the leadership role of legislative initiatives appears to be on the defensive, and even the minimum-safety-net perspective is under attack for reasons of costs and aversion to bureaucratic intervention. This is buttressed by the recent emphasis, voiced by economists, that legislative interventions are often utilized by those who are regulated so as to capture the rents and protect themselves rather than the public interest, and that public initiatives are often offset, in part at least, by the responses of the private parties to the new constraints imposed by the legislation.

With respect to capturing the rents, for example, incumbent workers may support any legislative initiatives that increase the termination costs to employers since this would enhance their employment security, although probably at the expense of reduced job opportunities for potential new workers. With respect to the private parties at least partially offsetting public initiatives, legislation on such factors as advance notice and severance pay may reduce private or collective bargaining over such issues, as well as reduce initiatives on the part of employers and employees to take specific precautions or make specific arrangements to reduce the need for such termination policies.

The question then becomes: Which institutional arrangement — the private market, collective bargaining or legislation — is best equipped to deal with termination problems, and what is the appropriate balance amongst these mechanisms? While an answer to this question is beyond the scope of this study, posing the question does remind us that there are these alternative arrangements, they do involve tradeoffs (e.g., legislation may reduce private or collective bargaining arrangements), they

have complementary as well as substitute components (e.g., unions can articulate collective bargaining preferences and monitor outcomes), and they are driven by different mechanisms (e.g., profit and utility maximization versus voting pressures).

With respect to the market adjustment process, the problem is that there are losers, whom the market does not automatically compensate, and there is the possibility that judged even on its own terms of efficiency, the market may fail to yield a socially optimal reallocation of resources. Nevertheless, it is important to keep in mind the very real possibility that the displacements that are occurring as a result of the market reallocations likely lead to a more efficient allocation of resources, and that the resulting income losses are only one side of the picture. Such private income losses are obviously very real to the losers and they can engender considerable transfer payments, tax losses, and political resistance to the change. However, discouraging an adjustment that is ultimately more efficient is likely simply to postpone the inevitable income losses (perhaps exacerbating them by postponing any phased adjustment). Furthermore, ultimately transfer payments and tax losses are likely to be higher in a society that does not reallocate its resources to their most efficient uses.

Given that such adjustments seem both inevitable and desirable, the challenging issue becomes one of harnessing the best feature of the alternative mechanisms — the labour market, collective bargaining and legislation — to help achieve a speedy but humane adjustment, at the same time trying to avoid those self-serving features that impede the adjustment or distribute its consequences in an inequitable fashion. It is to be hoped that by indicating in theory and in practice how each of these mechanisms function with respect to layoffs of a permanent nature, some light has been shed on this issue.

The previous discussion also suggests a number of issues for policy consideration. Documenting the magnitude of the phenomenon would be assisted immensely by better information from the Labour Force Survey on flows into unemployment, categorized by reason for separation (e.g., permanent or temporary layoff, plant closing). At a minimum, even in a market-oriented economy, some government intervention appears justified in the case of mass layoffs in isolated communities where workers have roots, and in the provision of collective information and perhaps pilot projects on innovative industrial relations policies and on labour market forecasts.

Stronger types of intervention in the form of employment protection (e.g., more advance notice, severance pay, protection against unjust dismissals) are likely to reduce the employment opportunities of others (especially youth and women) and this is likely to increase the overall unemployment rate and reduce the pressure for concession bargaining. These consequences have to be traded off against the protection pro-

vided to incumbent workers and the fact that protection and compensation are likely to reduce worker resistance to technological change and other policies that jeopardize their jobs. In that vein, positive adjustment assistance in the form of compensation or relocation and retraining for new jobs is likely to be much more effective than the protection of jobs in declining sectors. Working against market forces, rather than supplementing them, is likely to lead to more severe adjustments in the long run. Unfortunately, the policy of compensating the losers will be complicated by the fact that their expected income losses may reflect rents in their old jobs (and such rents may be contributing to the job loss) as well as a wage premium for the risk of unemployment (in which case they would be doubly compensated).

Raising the ceiling of wage claims permissible under bankruptcy, or granting them a higher priority in the ranking of claims, is an attractive policy option because bankruptcy is likely to be an unanticipated event and, hence, the adjustment consequences more severe. Nevertheless, we know very little, theoretically or empirically, about the ultimate incidence and consequences of such a policy. Hence, moves in that direction should be undertaken with caution.

Finally, it is trite — but nevertheless true in this area of permanent layoffs — to state that a buoyant economy would help the adjustment process immensely. Such a policy of expansionary demand to move the economy toward full employment would likely dissipate the pressure for special ad hoc protectionist measures to save jobs in otherwise declining sectors. In addition, a move toward full employment is likely to facilitate market adjustment mechanisms, and working with, rather than against, market adjustment mechanisms is likely to be the most viable overall policy option in the long run.

Notes

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1. This information is from monthly layoff reports published by the Canada Employment and Immigration Commission, giving information on permanent, indefinite and temporary layoffs by name and location of firm, industry, and workers affected. The information is collected by local Canada Employment Centre managers in the course of their normal operations; firms are not required to report layoffs to the employment centres. The monthly layoff reports specifically indicate tht "the coverage of layoffs in Canada by this method is neither complete nor accurate . . . accordingly, the figures given in the attached listing should not be totalled and used to represent the number of persons laid off in Canada in a given period" (Canada Employment and Immigration Commission, Monthly Layoff Reports). For these reasons no attempt is made here to construct a consistent series from the CEIC Monthly Layoff Reports.

2. The unemployment rate for a group is the product of a turnover rate and the average duration of unemployment of that group entering into the state of unemployment. Thus, any change in the overall unemployment rate is the change in the turnover rate weighted by the average duration of unemployment plus a change in the average duration of unemployment weighted by the turnover rate. As overall unemployment increases, both the turnover rate and the average duration of unemployment would be expected to increase for job losers. However, for job leavers, new entrants or reentrants, turnover rates are likely to decline as they persist in their jobs and postpone entry, given the high unemployment.

   With turnover rates increasing for job losers and decreasing for job leavers as unemployment increases, it is to be expected that job losers would constitute a growing component of overall unemployment. This does not necessarily mean that the rate of job loss (turnover) of job losers would increase as fast as their unemployment rate. Since job losers who suffer permanent layoffs tend to experience the longest average duration of unemployment (Glenday, 1982), slight increases in their rate of job loss will result in their making a disproportionately high increased contribution to the overall unemployment rate, since their higher turnover rate is weighted by a high duration. In essence, job losers make up a growing component of the unemployed as unemployment increases, not only because they experience a higher probability of being unemployed, but also because they have a high duration of unemployment. This is consistent with unemployment insurance data, which show that the number of benefit weeks paid (reflecting the long duration unemployment of job losers) has increased faster than the number of newly unemployed workers starting unemployment insurance claims (Glenday and Adam, 1982).

3. The methodology is elaborated upon in Glenday (1979), Glenday, Jenkins, and Evans (1982), and Jenkins and Kuo (1978). Income loss estimates were based on retrospective survey data from the Department of Industry, Trade and Commerce's *Labour Force Tracking Survey*, which documented the reemployment experience of workers who suffered permanent job losses from 1974 to 1976. The results are generally consistent with other studies of the employment consequences of trade liberalization (discussed in Glenday, 1982; Harris, Lewis, and Purvis, 1982; Pearson and Salembier, 1983) and of plant closures (discussed in Bluestone and Harrison, 1982; Gordus, Jarley, and Ferman, 1981; Lipskey, 1970; Ontario Ministry of Labour, 1984; Stern, 1972). The severity of the income loss being greater in recessionary periods of high unemployment than in normal economic times has also been documented in Cooke (1979, p. 224); Shapiro and Sandell (1983, 1984); and Stern, Wood, and Hammer (1979, p. 150).

4. Severance pay or voluntary buyouts may be particularly important under deferred wage compensation systems. In such circumstances employers may also adjust features of their pension plans to induce early retirement (Lazear, 1982). Severance pay, like defined benefit pension plans, may also serve to lock workers to their particular employer, making them reluctant to leave a sinking firm, given that prior resignation would mean that they would not receive the lump-sum severance pay.

5. As stated in Eshelman (1971) in his critique of Stoikov's (1969) analysis of the rationale for severance pay: "The combination of premiums and unemployment benefits which develop in a competitive economy will be that which best satisfies preferences towards risk." This highlights the fact that a job can be viewed as a package of desirable characteristics (e.g., good working hours) and undesirable ones (e.g., risk of severance), each with a price, the sum of which constitutes the wage.

6. Many of these market failure problems are elaborated upon in more detail in Saunders (1984), in the context of aid to workers in declining industries, and in Gunderson, Halpern, and Quinn (1984), in the context of the labour market implications of corporate bailouts. The latter is part of a larger study being conducted by the authors with Michael Trebilcock and Marsha Chandler in *The Political Economy of Corporate Bailouts*, for the Ontario Economic Council.

7. The distinguishing characteristics of mass, as opposed to individual, layoffs in affecting the search time of other workers is emphasized in Harris, Lewis, and Purvis (1982, p. 35) and Tobin (1972).

8. As emphasized by Ramaswami (1983), market wages obviously respond to the job-

finding rate, and the latter can be different in situations of mass, as opposed to individual, layoffs.

9. Such a policy was proposed in the Ontario Ministry of Labour (1983).
10. The economic rationale for seniority rules has been the subject of recent theoretical work on optimal labour contracts. Carmichael (1980), for example, attributes seniority rules in part as a way of circumventing the moral hazard problem that arises when individual workers can influence the probability of being terminated so as to collect severance benefits. Abraham and Medoff (undated) provide survey evidence based on U.S. data indicating that while both senior union and non-union workers have protection against terminations, the relative protection of senior union workers is much greater than senior non-union workers. Such protection for both union and non-union employees may be necessary for them to accept deferred compensation (i.e., wages less than their productivity when young, and greater when older). Deferred compensation may in turn have an efficiency rationale since it encourages work effort and honesty (e.g., Lazear, 1979), discourages unwanted turnover, provides employees with a financial incentive in the solvency of the firm and in the public sector, and enables the intertemporal substitution of costs to future generations of taxpayers (e.g., Gunderson, 1983). Abraham and Medoff (1982) survey both thc theoretical literature justifying deferred compensation and the empirical evidence on its existence.
11. For an extensive discussion of arbitral decisions through the grievance procedure see Brown and Beatty (1984), chap. 6 on seniority issues and chap. 7 on discipline relating to just cause.
12. The results here are similar to those shown in the Department of Labour's submission to the Carrothers Commission (Canada, 1979) and discussed in Adell (1981, p. 38).
13. As stated by Adell (1981, p. 82): "Collective bargaining has given relatively little protection against termination occasioned by the economic circumstances of the enterprise."
14. A stronger rationale for legislative initiatives pertains to the need to protect what could be considered a worker's vested property right to a job (e.g., Beatty, 1980; Stoikov, 1969). Such a right has been advanced as basic, given the fundamental importance of employment, not only for income but also for personal fulfilment.
15. Requirements are summarized in the *Canadian Labour Law Reporter* (1984, pp. 963–64).
16. George Vassos, of David Harris Esq., a lawyer specializing in wrongful dismissals, at a seminar on wrongful and unjust dismissals, Centre for Industrial Relations, University of Toronto, February 15, 1984.
17. Canadian evaluations have been conducted by Adams (1978), and preliminary results from a number of other studies — E. Shantz and R. Rogow for British Columbia, and B. Brady and G. Trudeau for Quebec — were presented at the 21st Annual Canadian Industrial Relations Association meeting, University of Guelph, May 30, 1984.
18. An excellent summary (from which this section draws) of the collective dismissal and insolvency procedures in the ten member states is given in the *European Industrial Relations Review* (Feburary 1983). Foreign experiences are also discussed in Yemin (1982) and the International Social Security Association (1981).
19. Jenness (1984) suggests that in response to collective bargaining or governmentally imposed constraints on permanent layoffs, employers may create buffers of precarious employment through increased use of temporary or part-time help, outside contracting and overtime in preference to permanent hirings.
20. Of course, the extent to which this may become an actual problem depends upon the magnitude of the expected severance costs involved, and it could be argued that they are small compared to other wage and non-wage costs and other factors that affect location decisions.

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5

Training and Skill Development

JAMES B. DAVIES

Considerable concern has arisen in Canada about whether our training and skill development systems are adequate. In the period immediately preceding the recession of 1981–82, there appeared to be serious shortages of some kinds of highly skilled and educated manpower. Also, there has been a continuing fear that our education and training systems are not reacting satisfactorily to the pace of technological change. These anxieties reflect a concern with public institutions, with the adequacy of private sector training, and with the interactions between the two levels of government and the private sector.

This study attempts to evaluate these concerns and to formulate some policy recommendations. It focusses principally on the arguments for and against policy changes for economic efficiency. However, some attention is also given to equity rationales for policy change, which involve considerations of income distribution and equal opportunity. The aim of the study is to synthesize the results of previous research and policy discussion, but, of course, the author's viewpoint colours the interpretation. The paper will not deal with all the issues raised by training and skill development, but will attempt to answer the following key questions:

- What demands will be placed on educational and training institutions in the future and will these institutions respond to these demands?
- What is the appropriate role of government in training and skill development?
- What institutional mechanisms would efficiently allocate the risks associated with skill obsolescence?
- Is the amount of on-the-job training (OJT) in Canada adequate and, if not, what institutional changes are needed to increase OJT?

- What federal-provincial cooperation or changes in the nature of the economic union would facilitate labour market adjustments?

The paper is organized as follows. The next section briefly describes the current systems of education and training in Canada, with particular emphasis on changes that have occurred within the past few years. Then, the recent Canadian literature on training and skill development is described. The following section describes, in terms of economic theory, the kind of training and skill development we would get in the absence of government, and examines the current effects of government actions on training. Finally, the policy implications of this study are discussed.

Training and Skill Development in Canada

This section outlines briefly the current state of training in Canada, and recent changes in this training. It focusses on elementary and secondary schools ("schools" for short), the post-secondary system, institutional manpower training, and on-the-job training or "training in industry." At each level, our concern is only with activities which increase employability or earning power — that is, with training and skill development ("training" for short). Other components of education are not discussed.

The Schools

Elementary and secondary students in Canada are almost entirely enrolled in public or separate school systems supported by taxation. Students from Catholic families in some provinces may choose between public and separate schools. A minority of students are enrolled in private schools partially supported by taxation. For example, in Quebec and British Columbia there are general subsidies to tuition at private schools.[1]

Until a few years ago Canadian schools had seen an increasing trend toward more liberal education: more choice of courses and flexibility of curriculum, new teaching methods, and de-emphasis of formal exams. The results are now widely perceived as having reduced the quality of education. There has been increasing concern that the schools are not preparing students adequately for the world of work. The result has been an increasing tendency for parents to withdraw their children from public schools, and for initiatives by provincial governments aimed at increasing standards.[2]

While the popular perception is that standards have deteriorated in the schools, longitudinal studies across Canada do not support this view. Nyberg and Lee (1978) surveyed these studies, finding improved performance about as often as declining achievement. They also report that, in the opinion of chief educational officers whom they surveyed across the

country, standards had risen in the sciences, stayed about steady in mathematics, and declined somewhat in literature and language.

That standards have not in fact declined would be consistent with the steady increase in real expenditures per student in the schools, both absolutely and relative to that at the post-secondary level over the last 25 years.[3]

The Post-Secondary Level

In the 1981–82 school year in Canada there were about five million students at the elementary and secondary levels and 675,100 full-time students at the post-secondary level: 401,700 at the universities and 273,400 at the colleges.[4] These relative numbers have been static. Twenty years ago there were relatively more students at the elementary and secondary levels, and relatively more university than college students.

In contrast to the schools, the universities and colleges have not seen major innovations in teaching methods, curriculum, or methods of evaluation. The interesting changes have occurred in finance, levels of spending, and patterns of enrolment.[5]

From 1951 until 1967, the federal government provided the universities with a flat subsidy per student. Grants were not open-ended. Each province received a predetermined amount which was simply divided among its universities on the basis of enrolments. From 1968 to 1977, in contrast, open-ended, revenue-matching grants for all post-secondary expenditures were introduced.[6] Over this period, both universities and colleges expanded considerably for the nation as a whole. However, in the early 1970s enrolments stopped their meteoric rise and a period of moderate growth began. Also in Ontario, in the early 1970s the provincial government set out on a period of restraint in university finance which has continued to the present. These trends helped to keep in check the expansionary forces created by the federal grants regime.

In 1977, under the Federal-Provincial Fiscal Arrangements and Established Programs Financing Act, federal support once more was radically transformed, and took on its present form.[7] In place of open-ended matching grants the provinces were to receive lump-sum payments. These were ostensibly to support post-secondary education, but in fact would not vary with respect to post-secondary spending by the provinces. Perhaps not surprisingly, since 1977 there has been a slowdown in the rate of increase of real per student expenditure at the post-secondary level in almost all provinces, the most extreme examples occurring in Ontario and British Columbia.

For their part, the provinces have instituted a variety of mechanisms and procedures for funding the universities, both across provinces and over time (Leslie, 1980, pp. 233–312). In 1967–68 Ontario implemented a

system of formula operating grants which has been emulated to some degree in most of the other English-speaking provinces. Under this scheme, weights related to the costs of different kinds of programs are applied to enrolments in the various universities to calculate weighted enrolments. What funds the provincial government is willing to devote to the operating expenditures of the universities are then distributed largely in proportion to these weighted enrolments.

In fact, the pure enrolment-based operating formula was only used in Ontario until 1977–78. Starting in 1978–79, half of the funds which would ordinarily have been distributed by the formula were distributed in proportion to enrolments in the base periods 1974–75 and 1976–77. Given the importance of other discretionary grants, Leslie (1980, p. 291) points out that two-thirds of the provincial support to universities in Ontario is now largely based on historical ratios rather than current enrolment.

Alberta, Saskatchewan and Manitoba have gone through a similar process. As early as 1967 they introduced formulas modelled on the Ontario system, but have since gone over to discretionary funding based largely on historical ratios. The enrolment vicissitudes of the early 1970s broke down the integrity of the formulas by necessitating ad hoc adjustments. British Columbia has had discretionary funding throughout. The Maritimes have banded together in a regional system which intends eventually to make use of a formula, but historical ratios have so far been much more important. Finally, Quebec has used a distinctive system in which there are annual adjustments in funding based on enrolment changes. These typically have discounted enrolment changes considerably: if enrolment goes up, for example, by 10 percent, funds might rise only by 5 percent.

The overall situation in the university portion of the post-secondary system is that most funding is discretionary, or is based on dividing up whatever a province feels it can afford to pay on the basis of the relative historical support for different institutions. The tuition fees paid by students thus often represent almost the only financial incentive for universities to respond to changes in the structure of enrolment demand. But even this incentive mechanism is circumscribed because fees are heavily controlled by provincial governments. There are, therefore, theoretical reasons to expect some lack of response to enrolment demands at the post-secondary level.

Important changes in the composition of enrolment at the universities and colleges have occurred over the past 20 years, during which time there has been a steady increase in part-time enrolment and the enrolment of women. In 1962–63 the number of part-time undergraduates was 31 percent of the number of full-time undergraduates, and by 1982–83 this ratio had risen to 63 percent. A study by Nakamura and Nakamura (1985) indicates that the number of women rose from 33.7 percent of full-

time undergraduates in 1966–67 to 46.6 percent in 1981–82. Striking changes have also taken place in relative enrolment in different faculties. In the early to mid-1960s, the relative importance of arts and science enrolments increased considerably. Arts then entered a long decline, which has continued to the present. In 1966–67, 45 percent of the full-time undergraduates at Canadian universities were in arts; by 1981–82 the figure had fallen to 25 percent. Science has held its share steady since the early 1970s, with 15–17 percent of undergraduate enrolment, while business administration and the smaller vocationally oriented faculties (excluding law, medicine, nursing and engineering) have greatly increased their shares. In 1981–82, for example, 13.3 percent of full-time undergraduates were in business, while in 1970–71 the figure was just 3.4 percent.

It is apparent from the above figures that, despite funding rigidities, the universities are responsive to broad changes in enrolment demand.[8] Whether they are sufficiently responsive, and whether quality responds as well as quantity, cannot be determined without detailed empirical study. Nevertheless, there have been persistent claims of insufficient responsiveness (e.g., Light, 1984).

Prior to the recession of 1981–83 it was widely believed that engineering and computer science enrolments were not expanding quickly enough. It has been argued that we still ought to be concerned about these problems, and about related imbalances expected in the future, such as too few doctorates in engineering and the physical sciences (Canada, Department of Employment and Immigration, 1983a, pp. 26–27, and Light, 1984, p. 3). However, it is not obvious from the available figures that these concerns are well-founded. Between 1977 and 1981 the number of engineering graduates rose at an average annual rate of 9.1 percent in Canada (Statistics Canada, *Education in Canada 1982*, p. 70). Over the same period, in Ontario, average annual increases in graduation of 7.8 percent were recorded for engineers and 7.7 percent for computer scientists (Council of Ontario Universities, 1982, p. 73). Thus, while the speed of response may have been too slow, it was far from zero.

In fairness to the universities, it must be concluded that the gross evidence does not support claims of a lack of responsiveness to enrolment demands. Nevertheless, in a freer market setting, the strength and quality of their responses might be stronger. The enrolment and graduation figures examined here do not provide a stringent test of responsiveness.

Engineering enrolment at the end of the 1970s is interesting from the standpoint of the problems created by the fragmented nature of the post-secondary system. A possible weakness of the Canadian post-secondary system is that it is under provincial control, whereas the labour market which graduates enter is a national market. It therefore seems possible that national education goals might not be achieved because they do not

correspond with provincial goals. If ever this were to emerge as a serious problem, it surely would have done so in the engineering situation of the late 1970s. At that time, most new engineering jobs were in the resource sector, and in the West. Engineering schools in the West increased enrolments and output very quickly in response to these job opportunities. Between 1977 and 1981 the number of engineering graduates in the four western provinces rose from 877 to 1,330, an average annual increase of 11 percent. However, the total number of engineers produced in Canada rose only from 4,445 to 6,173 during the same period, for an annual rate of increase of 8.6 percent.[9] The number of engineers produced in the six eastern provinces rose from 3,568 to 4,843 over the period, which was at an average annual rate of 7.9 percent. If all provinces had increased their output of engineers at the same rate as the western provinces, the number of graduating engineers would have been 6,743 instead of 6,173 by 1981 in the country as a whole. Although more engineers would have been produced if all engineering schools had geared up at the same rate as the western schools in the late 1970s, it might not have been desirable because the subsequent collapse of the resource boom reduced employment opportunities. An optimist might view it as natural that the relative importance of western engineering schools should have increased in this period, and point to the salutary fact that the eastern schools considerably increased their output in response to increased student demand despite the fact that, initially at least, the incremental engineers were bound out of province.

In one important respect there has been a lack of change during the past 10 to 20 years. Traditionally, a much larger proportion of children from high- rather than low-income families have participated in post-secondary education. Statistics Canada found in 1974, for example, that 55 percent of children from families with annual incomes of more than $25,000 attended post-secondary institutions, while only 11.6 percent of children over 18 from families with incomes under $5,000 did so (Osberg, 1981, p. 186). In his study of the distribution of benefits from the Ontario university system, Mehmet (1978, p. 45) concluded that "the principal net gainers from the university system are the middle and upper income groups at the expense of the lower income groups." In this view the university system is a tax-transfer system in which the relatively poor groups tend to subsidize the relatively rich.

Our policy of providing heavily subsidized post-secondary education to all qualified high school graduates who wish to participate certainly must promote equality of opportunity. However, it appears at the same time that this policy results in redistribution from low- to high-income families. The section on policy conclusions at the end of this study discusses the possibilities for reducing this perverse redistributive effect without impairing equality of opportunity.

Institutional Manpower Training

From the Adult Occupational Training Act of 1966 up to the National Training Act of 1982, the federal government provided institutional manpower training in Canada to adults through the Canada Manpower Training Program (CMTP). Training was provided primarily to those who had been out of formal schooling for at least 12 months,[10] and course duration was limited to 12 months. The training was provided in provincial institutions, mainly community colleges. After 1974 each province had a guaranteed floor level of funds indexed to the Consumer Price Index (Ostry and Zaidi, 1979, p. 175). This introduced a rigidity and a lack of incentives for the provinces, which was held by some to be partly responsible for the sometimes poor showing of the program in increasing the earnings and employability of trainees. Under the National Training Act, CMTP has been replaced by arrangements with the provinces for the provision of institutional training, a system which apparently provides for greater flexibility.

Until the inauguration of the National Training Program in 1982, the federal response to the criticism of CMTP took two main forms. First, the proportion of CMTP trainees enrolled in the low-level BTSD (Basic Training for Skill Development) courses was reduced somewhat. Second, the number of CMTP trainees relative to trainees in industry was steadily reduced.[11] Thus, there was a shift of resources from lower-level skills toward higher-level skills, and from institutional training to industrial training.

The National Training Program (NTP) has made several important changes in institutional manpower training. For example, if there is a skill shortage, or the trainee has no other opportunities to acquire the skill, enrolment may start before the trainee has been out of school for a full year. This means that in future the non-apprenticeship component of manpower training may become an additional bridge for young people between school and work. In addition, the maximum length of a course has been increased from 12 to 24 months (for higher-level skills). Also, higher income-support rates are now provided to encourage laid-off apprentices to continue training, and for workers to retrain in "demand occupations" when they have been laid off for reasons such as technological change.

A further important element in the NTP is the development of the Canadian Occupational Projection System (COPS), a new system for overall allocation of training resources. This computer-based system will draw on forecasts of occupational demand and supply from employers, unions, governments, and educational institutions. From these forecasts, it will project the degree of balance in a detailed list of occupations. Access to the system will be by computer links, and users

will be able to experiment with alternative scenarios and to utilize the system for help in making their manpower or training plans. Occupations with national or regional demand in excess of supply will be designed as "national occupations," and training resources will be directed to them on a priority basis.

On-the-Job Training

According to the estimates of Mincer (1962, p. 63) for the United States in the late 1950s, at least for male workers, "it is probably correct to say that . . . on-the-job training — measured in dollar costs — is as important as formal schooling." In Canada, recently, there has been an increase in intervention by provincial and federal governments in this heretofore largely neglected sector of our training system. One important impetus for this development was the disappointing experience in the 1960s and 1970s with institutional manpower training. On-the-job training (OJT) has become more urgent because of apparently serious shortages of particular kinds of skilled labourers such as machinists, machinery mechanics, tool and die makers and because of the fear that unassisted industry will not be able to retrain workers for the rapid technological changes of the 1980s.

Throughout the 1970s and into the 1980s there was a gradual shift of the training resources of the Canada Employment and Immigration Commission (CEIC) away from CMTP toward the Canada Manpower Industrial Training Program (CMITP), which subsidizes on-the-job training.[12] Another program, specifically aimed at alleviating apparent shortages of labour in certain trades, the Critical Trades Skill Training (CTST) program, was introduced in 1981. It differs from CMITP in being targeted on a narrow range of trades and in providing training for up to two years, rather than the 12 months under CMITP. Finally, other wage subsidy programs, such as Career Access, also have been introduced; they contribute to training by helping young people and other special groups obtain jobs that will help them "get started" in the labour market.

Wage subsidy programs to stimulate OJT have also been introduced by provincial governments.[13] In Ontario there are at least two major programs. The Ontario Career Action Program provides trainees for up to 16 weeks at zero cost to employers. The trainees must be between 16 and 24, have been out of the formal education system for at least three months, be currently unemployed or looking for a job, and never have had a full-time job related to the trainee's chosen line of work. They receive training allowances of $100 per week. Participation is limited to a single enrolment. During the 1983–84 fiscal year, 13,500 trainees were assisted at a cost of about $20 million. The Ontario Training Incentive Program, announced in September 1983, was designed to provide payments of $1,000 each to an employer and an employee where the

employee is kept in an on-the-job training course for a full year. It was expected that up to 9,000 workers would be assisted in the initial year of the program.[14] While per trainee expenditures are less than those in CMITP and CTST, it is interesting to note that estimates of the number of trainees to be assisted in these two Ontario programs adds up to twice the current number of CMITP and CTST trainees (22,500 vs. 11,200 for the federal programs). Perhaps provincial initiatives deserve closer study.

Although one ostensible purpose of switching resources from institutional training to OJT is to exploit the informal learning processes on the job, it has been alleged that the design of the federal CMITP and CTST programs restricts the extent to which this occurs (Simpson, 1983, pp. 22–23). Both programs only subsidize formal instruction, that is classroom training in the firm. Aside from trainee wages, no subsidy is provided for the costs of informal instruction. This kind of support does not appear as attractive as the lump-sum support provided under the Ontario Training Incentive Program.

Finally, it has been widely suggested that the shift of CEIC training resources away from institutions and toward OJT, and the intention under the NTP to focus training on high-demand occupations, represent a major change in the purpose, and the probable effects, of federal support for manpower training. The belief is that objectives such as offsetting regional differences in unemployment rates and pursuing distributional objectives are beginning to take second place to an efficiency focus. To put it another way, resources are being directed to the areas where the largest increases in output can be generated per training-dollar.

There indeed has been a shift from distributional to efficiency objectives in training, but the change may be less radical than has been suggested. Women, native people, and other disadvantaged groups might be expected to get less than their share of OJT under programs such as CMITP and CTST. In order to benefit, a trainee must be hired by an employer and employers might be expected to shy away from these groups. However, the disadvantaged are subsidized at higher rates, and evidently get a good share of the OJT positions.

Conclusion

In terms of the concerns of this study, the most important points emerging from this description of existing training in Canada are as follows:

- The increasing real expenditures per student, and the greater emphasis on counselling and on the basics in the schools, may imply that the typical high school graduate will be better prepared for the labour market in the near future.
- The decreasing real per student expenditures, government control of

fees, and provincial funding mechanisms that discourage responsiveness to enrolment demands may be limiting the ability of our universities and colleges to react to changes in the employment market demands. However, this is still not apparent from enrolment trends.

- The shift of federal manpower training resources from low-level institutional programs toward skill training in institutions, and away from institutions toward training in industry, together with the new National Training Program, constitute a major shift in the disposition of federal support for training and skill development.

Recent Literature on Training and Skill Development

There has been much recent literature on training and skill development in Canada. This section will review briefly, and rather uncritically, what has been said. A more critical treatment will come in the next section which develops a theoretical perspective. The documents to be surveyed include the Dodge and Allmand reports, the Economic Council of Canada's *In Short Supply* (1982), and the 1983 report of the CEIC's Skill Development Leave Task Force, *Learning a Living in Canada*.

The Dodge Report

Labour Market Development in the 1980's, the July 1981 report of the CEIC's Task Force on Labour Market Development (the Dodge Report), crystallized concerns that had developed in the late 1970s about labour market imbalances. Its mandate was to provide an overview of the broad directions of federal labour market policy — that is, not just training and skill development policy.

As a first step the task force forecast the demand for labour in Canada for the period 1981–85, making its projections on the basis of alternative assumptions about growth in different industries and a constant occupational structure within industries.[15] Labour force growth and composition were also projected. Finally, the supply of labour to some of the higher skill trades, and the supply of highly qualified (i.e., university-educated) manpower (HQM) were forecast. Projected imbalances were obtained for the higher skill trades and HQM.

Assuming the continued low immigration of workers in the higher skill trades, high excess demand was projected under all scenarios, while in the market for HQM moderate excess supply was anticipated.[16] The severe recession of 1981–82 and high rates of unemployment experienced since have played havoc with these projections, illustrating the dangers of this type of forecasting. On the basis of these predictions, and the anticipated large changes in the structure of overall labour demand and labour force participation, the Dodge Report identified five major

areas for change in labour market policies. These now must be viewed in light of the changes in labour market conditions experienced since the Dodge Report. The two of interest here are as follows:

> i) Training policies should be carefully oriented to meet the emerging needs of the expanding sectors of the economy.
> ii) In a decade of uncertainty, greater effort will have to be made to improve adjustment mechanisms so that expanding industries will have access to the skill and labour which they require, while workers in declining industries do not bear undue costs. (Canada, Department of Employment and Immigration, 1981, p. 202)

The Dodge Report perceived the federal government as having considerable degrees of freedom within which to redirect its expenditure in support of training so that more people could be trained for occupations in high demand. It recommended a reallocation of federal funding for education and training. Less should be given to support the universities and low-level manpower training, and more should be spent on higher-skill training both in institutions and on the job, and in support of college training for technicians, technologists and para-professionals. Within each level, the Dodge Report also recommended that there should also be a reallocation of funding to meet changing labour market conditions and to encourage more flexibility.

The changes that have taken place under the NTP appear to have implemented the main recommendations of the Dodge Report on manpower training. However, at the post-secondary level (where federal expenditures are actually much larger), reallocation of funding and the encouragement of flexibility are more difficult. As mentioned in the previous section, in 1977 the federal government had abandoned any attempt to influence the direction of post-secondary programs by opting to provide its support in the form of lump-sum grants under the Established Programs Financing (EPF) of the 1977 Fiscal Arrangements Act. Thus the system in place at the time the Dodge Report was written was at the furthest possible non-interventionist extreme.

In view of the proposals by the Skill Development Leave Task Force in 1984, it is interesting to note the views expressed in the Dodge Report in regard to retraining and educational leave. The British experience with a levy-grant scheme — under which employers pay a tax of, say, 1 percent of payroll and receive grants for approved training — was carefully reviewed. The lack of success of the British scheme, which was phased out in the 1970s, was noted,[17] and concern was expressed about the inequity of placing additional burdens on employers to support increased training when subsidies to formal education are so large. A comprehensive scheme of paid educational leave was not discussed, the recommendation being that increased funds should be expended under existing programs for training in industry.[18] It was suggested, however,

that workers should be allowed to save to go back to school via Registered Educational Leave Plans (RELPs), comparable to the familiar RHOSPs, on a tax-sheltered basis.[19]

The federal post-secondary strategy advocated in the Dodge Report had the following key elements:

- Less should be provided in the form of base support, that is, presumably less in the form of EPF. It was expected that this might result in greater reliance on tuition fees as a source of finance, which would stimulate enrolment responsiveness.
- Support available under the Canada Student Loan Plan (CSLP) should be increased, extended to part-time students, and augmented in programs where labour markets are expected to be tight. Switching funds from EPF to the CSLP for these purposes would result in an automatic redirection of some support according to enrolment demand, and would make increased reliance on fees palatable to the public.
- The federal government should provide grants to match corporate contributions to universities and colleges to establish new specialized training programs. There should also be renewed support for co-op education and thrust funding for expansion in disciplines in high demand.

We have seen in the previous section that some changes along these lines have already occurred. The unilateral federal termination of the revenue guarantee in 1982, and the curtailment of scheduled EPF increases under the "6-and-5" inflation restraint program freed up some funds which may be viewed as having been redirected toward the expanded CSLP.[20] These changes only depart from those recommended in the Dodge Report in their magnitude (the Dodge Report evidently had a larger reallocation in mind) and in that CSLP borrowing limits have not been differentiated for the various types of students' programs.[21]

The Allmand Report

The mandate of the Parliamentary Task Force on Employment Opportunities for the 1980s, under the chairmanship of the Hon. Warren Allmand, appointed in April 1980, was to assess shortages in skilled trades and higher-skill occupations in Canada, to recommend initiatives, and to review existing federal policies and program intended to deal with skill shortages (p. 127). The task force maintained in its report that there was considerable evidence of skill shortages in Canada. It saw these shortages as an example of pervasive imbalances in labour markets. Other major imbalances highlighted in the report include unemployment and excessive or insufficient migration.

The evidence concerning skill shortages that was summarized by the Allmand Report was based on submissions made to the task force by

employers, labour groups, and others. No manpower forecasting was carried out. The task force reported that the evidence presented to it by experts suggested that the available data were poor, and that the methodology was not sufficiently well developed to enable useful projections to be made (p. 37). The principal difficulty was considered to be the supply projections.

Unlike the Dodge Report, the Allmand Report does not analyze the adjustment mechanisms that resolve imbalances, or the possible shortcomings of such mechanisms. However, it makes sweeping policy recommendations — 186 of them! Few of these proposals call for a reduction in government expenditure, while many do the opposite. An indication of the more interventionist tack of the Allmand Report is given by the conclusion it draws that increased efforts are required to attack illiteracy. One solution, it suggests, is for the CEIC's low-level Basic Training and Skill Development (BTSD) program, so frequently maligned, to be expanded. It recommends more support for on-the-job training; the foundation of new high-technology institutes; co-op education; new taxation expenditures to support training; and the liberalization of CSLP. In sum, the Allmand Report clearly envisaged the need for a considerable increase in government expenditures on education and training.

The Allmand Report also proposed new forms of government regulation. Recommendation 92, for example, suggests that whenever a new project employing more than 500 people is planned, its organizers should be required to produce a "human resources needs plan" which would commit them to hiring and training as much local labour as possible. (It is interesting to note that elsewhere there are numerous recommendations to provide support for labour mobility.) Recommendation 102, in the same vein, suggests that "companies which seek to import skilled people should be required to agree to a training plan that will produce qualified Canadians for the future and, where feasible, should be required to submit a five-year forecast of their manpower requirements."

It is difficult to see which initiatives the Allmand Committee believed would be most productive. In a number of cases, several alternative approaches to a problem receive warm endorsement. For example, if all the measures proposed to encourage OJT and retraining were implemented, a firm employing workers in shortage occupations would benefit from accelerated depreciation on machinery used in training, a levy-grant scheme in support of training, general subsidies in the initial periods of apprenticeship or OJT, special grants and subsidies to its training costs if it were designated as employing workers in critical trades, and tax incentives to send its employees on paid educational leave. The workers, in addition, would receive the following support for any training or retraining: tax deduction for any funds contributed to a proposed Registered Education and Training Saving Plan (RETSP),[22]

loans under CSLP, and special forgivable loans, on condition of returning to the initial employer for some period of time.

Because of the 1984 proposals by the Skill Development Leave Task Force, it could be useful to highlight the Allmand Report recommendations directed toward paid educational leave. It suggests that costs could be subsidized partly by generous loans and tax incentives to workers, and partly by unspecified tax incentives to employers. Enriched tax incentives to employers would be offered in cases of skill shortage or for selected employment opportunities. Employers would also be subject to a levy-grant scheme in support of training,[23] which would tax payrolls at a low flat rate (perhaps 0.5 percent) and allow tax credits for training expenses up to that amount. Expenses for training at colleges or universities would be eligible, so that this would be partly a program in support of educational leave.

Although the Allmand Report did not call for any cutback in funds for post-secondary education, its numerous proposals for increased support to OJT call for increased relative expenditure on OJT. The principal difference from the Dodge Report in regard to the overall allocation of education and training expenditures is therefore that a large increase in global expenditures is countenanced by the Allmand Report, while the Dodge Report assumed a need to avoid increases in expenditure.

In Short Supply

In 1982 the Economic Council of Canada made its contribution to the skill shortage and skill development discussion with *In Short Supply: Jobs and Skills in the 1980s*, the title of which echoes the identification in the Allmand Report of the twin imbalances of unemployment and skill shortage.

The ECC report makes two original contributions to the assessment of skill shortages. The first is a projection of vacancies by occupation to 1990. This is performed by the use of the Candide 2.0 model and a set of assumptions about industrial growth during the 1980s. The methodology is similar to that used in the Dodge Report forecasts, and therefore is subject to some of the same criticisms. However, no attempt is made to predict occupational imbalances. Rather, attention is focussed on predicted vacancy rates — which it points out are imperfect indicators of shortages. The vacancy projections were not necessarily expected to correspond to shortages. However, many of the areas where vacancy rates are expected to be highest correspond to those areas where employers interviewed in the Human Resources Survey expected there would be shortages. The Human Resources Survey (Betcherman, 1982) constituted the second major contribution by the ECC to the study of skill shortages.

Like the Dodge Report, the ECC report contends that better labour market information is required for corrective action to eliminate shortages, and thereby reduce unemployment rates. Such information is required not only as an input in manpower counselling but also to guide government planning of manpower training. Thus the introduction of the National Training Program (NTP) in January 1982, with its emphasis on directing resources toward shortage occupations identified by COPS, is lauded in the ECC report.

The ECC maintains that another factor which slows adjustment to labour market demands is a failure of wage differentials to move as might be expected in response to shortages of manpower. The time series on wage differentials during the 1970s shows a number of cases where the relative wages of workers had decreased or stayed approximately constant in what appear to be shortage occupations, such as computer programming and operation, tool and die making, and maintenance plumbing and carpentry (pp. 67–69). It was suggested that one reason for this apparently paradoxical situation might be that unions promote the compression of differentials.[24]

Training initiatives recommended by the ECC report (pp. 98–99) included:

- Creation of local training councils in cooperation with the provinces, industry and labour. This would tailor manpower training efforts at the local level to the provision of increased supply in shortage occupations.
- Support for OJT should be redirected toward high-level, long-duration programs for technical and trades occupations.
- Steps should be taken to improve apprentice placement rates. Measures should be taken to make apprenticeship training more attractive, such as certification to be competency-based rather than time-based, and more provision of pre-apprenticeship training in public institutions in order to shorten the training period.
- The International Labour Organization (ILO) convention on paid educational leave should be ratified. The federal and provincial governments, along with industry and labour, should consider how to implement paid educational leave.

Learning a Living in Canada

The early 1980s saw the formulation of new directions for federal support to training and skill development. Still, no radical change in the range of programs providing training directly or encouraging its provision in the private sector had taken place.[25] With the 1983 publication of the report of the CEIC's Skill Development Leave Task Force, *Learning a Living in*

Canada, discussion entered a new phase when a radical change began to appear close to implementation.

As we have seen, the Allmand and ECC reports agreed that government support for paid educational leave ought to be provided. It was repeatedly argued that faster technological and other changes will make "retooling" of workers over their working lifetimes increasingly necessary in the future. The justification for supporting this retraining was considered at least as good as for initial post-secondary education.

Learning a Living in Canada reported on phase one of the Skill Development Leave Study, whose other two phases included a series of conferences with business, labour, provincial governments and educators, and a study by a seven-member advisory panel drawn from the same groups. The initial task force document surveyed foreign experience with skill development leave, as well as the views of business, labour and governments, and made a catalogue of possible policy initiatives.

The list of possible methods for supporting skill development leave provided in *Learning a Living* contains the familiar options: levy-grant, tax incentives to employers, a Registered Educational Leave Savings Plan, plus a few that have not been mentioned above. For example, it is pointed out that the government could simply legislate "earned time off" (Vol. II, p. 56); employees would earn one day off for training for every 20 days worked, or 10 days worked in designated occupations, and costs would not be subsidized. Another approach mentioned is the possibility of providing workers with vouchers which could be spent at any approved training institution in the private or public sector (Vol. II, p. 61).

The results of the Skill Development Leave study became apparent in March 1984 with the publication of *Learning for Life*, the report of its national advisory panel. This called for compulsory paid educational leave. As in the earned-time-off option sketched in *Learning a Living*, workers would earn one day off for (in this case) every 30 days worked — producing an entitlement to two months off after five years worked. Employers' costs, principally salaries for replacement workers, would be eligible for a tax credit.

The skill development leave initiative could have major effects. The proposal, as it has finally emerged, is that taxpayers should essentially pay the full costs. The expenditure involved could be large indeed. In the steady state, if workers took all the leave for which they were eligible, one-thirtieth of the labour force would be on paid educational leave at any point in time. With employment now at about 10 million, this implies an addition of about 300,000 students and trainees to the current total of about one million post-secondary students and manpower trainees. The cost of this would be about $6 billion per year, assuming foregone salaries averaging $20,000 — about the current average labour income — and ignoring other costs.

Problems of Government Intervention

Adjustment without Government

Ideal Conditions: Perfect Competition

The review of recent literature of labour market, education and training policy in Canada reveals a general dissatisfaction with the current state of education and training. It also reflects a growing desire for vigorous new public initiatives. It is therefore especially important at this time to consider carefully just why we want governments to intervene in education and training. It is only on the basis of such analysis that we can judge whether new initiatives are desirable and, if so, which of the competing proposals for reform should be adopted. This section provides such a discussion. Although the goal has been to make this treatment reasonably accessible, the discussion is more technical than at other points in the paper.

Under certain ideal conditions there would be no need for government intervention in training or skill development on efficiency, distributional, or equal opportunity grounds. Sufficient conditions are:

- no externalities;
- perfect capital markets and full insurance markets; and
- perfect competition throughout the economy — including the education and training sector.

To see what happens under these conditions, let us consider general and specific training alternatively. General training is useful in many firms, while specific training is only used in a single firm.[26]

General training may be obtained in a school or on the job. In either case, the student/worker must bear all the costs (often in the form of lower earnings) because no employer has any incentive to pay for this kind of training: an attempt to reap some reward from such an investment by paying a wage lower than the value of a worker's marginal product simply induces a quit.[27] In contrast, specific training is normally available only on the job, and the costs (and returns) are shared by employer and employee. Employees share in costs by accepting a wage lower than they could earn in a job with no training component, but the wage is above the value of the worker's marginal product so that the employer also bears part of the cost. Sharing of returns implies that after training the worker's wage will rise, but not to a level fully reflecting productivity. Sharing of the investment gives each party an incentive to preserve the employment relationship because it discourages quitting or firing and therefore protects the investment in specific human capital.[28]

The socially optimal amount of training, both general and specific, is obtained under the three special conditions listed above. Either the

worker (general training) or the worker-employer partnership (specific training) internalizes all the gains from training: private benefits correspond to social benefits. Also, the perfect capital, and full insurance, markets mean that private costs correspond to social. Hence education or training, which will be produced up to the point where marginal private benefits fall to marginal private costs, is also produced up to the point where marginal social benefits and costs coincide, giving efficiency.

Under the ideal conditions sketched, there is also no need for government intervention to achieve distributional goals or to assure equality of opportunity. In this kind of world, it will be more effective to make cash income support payments to the poor than to provide education or training in kind. The poor will go to school, like everyone else, up to the point where the rate of return from doing so falls to the prevailing real rate of return on investments in non-human capital. It would be inappropriate to tie assistance to further human capital investment. Also, since the poor would have access to full borrowing facilities and would not have to worry about the risks of human capital investment, because of full insurance markets, they would have no less opportunity to benefit from education than anyone else.

It is instructive to ask how the training and skill development systems present under these ideal competitive conditions would react to changes in the demand or supply for labour — especially changes in demand occasioned by technological progress.

A once-and-for-all increase in demand in an occupation under these ideal conditions would lead to a new long-run equilibrium, in which training would occur in a socially optimal fashion. Moreover, the transition to the new equilibrium would be efficient. The fact that it is not instantaneous would merely indicate that the marginal cost of providing more workers to an occupation is rising in the number produced in any period, so that it is advantageous to spread out the increased output over time, perhaps over several years. This is an important point, in view of the frequently expressed impatience with the speed of adjustment in actual labour markets and the calls for intervention which this impatience engenders. Skill shortages may be efficient, and it may be wasteful to attempt to hurry them along.[29]

A decrease in demand, perhaps occasioned by technological change, would similarly be accommodated efficiently. While an increase in demand probably would lead to an increase in relative earnings in an occupation during transition to a new equilibrium, a drop in demand probably would produce a temporary decline in relative earnings. However, a floor is set under this decline by other employment or non-market opportunities of the workers. It is also important to note that not all workers who exit the occupation will retrain or enter a new occupation.

Older workers especially may find that the net benefits of moving into the household sector exceed those of retraining. Here, too, government intervention to encourage retraining would be wasteful.[30]

Finally, changes in the structure of labour demand caused by technological change are worthy of further note because their optimal accommodation may call for innovation in the education and training sector, not just changes in enrolment composition. To take an extreme case, technological change may create entirely new occupations, requiring completely new programs in educational institutions and in firms.

With a competitive education and training sector, the need for innovation to provide training in new areas causes no problem. Initially, tuition fees for the new forms of training might be bid up. This would provide both a signal and an incentive for new programs to be developed, and in due course the required new workers would be supplied. The only difference from the case of a shift in demand for conventional kinds of labour is an extra lag along the optimal adjustment path as a result of the start-up costs of new educational and training programs.

Departures from Ideal Conditions

It is widely argued that real-world departures from the ideal conditions sketched above are so serious that they justify large-scale government intervention in education and training on efficiency grounds alone (e.g., Economic Council of Canada, 1982, pp. 80–81). Indeed, despite the already large role of the public sector in this area, in the last section we saw that much of the recent labour market policy literature sees imperfections as so severe that even more government initiative is required.

That greater planning, regulation, and control in education and training are required for Canada's prosperity is a proposition which has come to be routine. However, it is a remarkable point of view. We might first ask, for example, how Canada and the other advanced industrial nations have achieved their already highly skilled and specialized labour forces without central planning of education and training. How did our industrial societies adjust to past waves of technological revolution, such as automobiles, air travel, electronics, plastics and computers in the 20th century alone, without massive technological unemployment? Second, greater government intervention in education runs counter to the current trend in other sectors toward deregulation and greater use of the market mechanism.[31] Finally, education has a highly heterogeneous output produced in ways sometimes subtle and imperfectly understood. The structure of future demand is also difficult to predict. In other words, education may be a commodity especially little suited to state provision or control.

In view of these reasons for skepticism over the claim that government

intervention and control are required to offset imperfections in markets for education and training, it is a good idea to take a close look at both the suggested imperfections and remedies.[32]

Externalities

The first condition we listed above for private markets to provide efficient education and training was that there should be no externalities. In fact, it is widely argued that education has important external effects. Many of these, such as making good citizens and public health, are clearly most important at the elementary and secondary levels. Some subsidies to elementary and secondary education may therefore not be too hard to justify on efficiency grounds. But what of subsidies to adult training and post-secondary education? Can these be justified by externalities?

If university professors are engaged in basic research and are unable to capture the fruits of their creation of new knowledge through patents or otherwise, their efforts give rise to externalities. Output of basic research therefore will be suboptimal. This provides a possible justification for subsidies to the research function of universities. It may be that a good way to fund this research, at least in part, is to subsidize instruction. This will be a good method if basic research and university instruction are highly complementary, and if instruction is easy to measure but research output is not.[33] Thus we might argue in support of subsidies to the teaching function of universities in order to provide indirect support to research. This could be true even if we believed there were no externalities from the education provided by universities, and that there were no other reasons, such as equity considerations, to provide subsidies.

The major external effects of adult training and post-secondary education may be ones which do not arise naturally, but are caused by government activity.[34] For example, a more highly trained labour force may exhibit a lower unemployment rate. Under these circumstances, and because the costs of unemployment in our society are shared by taxpayers in general, training would have a beneficial external effect. Externalities of this type are discussed below where we examine departures from the simple world of competitive private markets caused by government.

Capital Market Imperfections and Incomplete Insurance

It is often suggested that student loans cannot be obtained without government assistance because of capital market imperfections. The failure of a private student loan market is more probably the result of certain standard difficulties in insurance markets. Because we cannot pledge human capital as security on a loan, any lender who extends an unsecured student loan accepts considerable risk. The lender is there-

fore providing the student with a form of insurance. By bearing a high interest rate, the student pays a premium which compensates the lender for a loss that might be incurred under default.

The breakdown of private markets in student loans is probably the result of two standard problems in insurance markets: adverse selection and moral hazard.[35] In the present context, adverse selection refers to the greater proclivity of higher-risk students to take out loans. Moral hazard is the tendency of workers who would not have done so in the absence of the loan to "drop out" or take other action allowing them to default on loan repayments. Both problems impose losses on financial institutions which may sometimes be successfully combatted by high interest rates. However, higher interest rates may deter low-risk borrowers, making adverse selection worse, and may encourage more moral hazard. Thus there may be no level of interest rates at which student loans can be profitably extended by private financial institutions.

Setting up government-sponsored student loans does not solve the problems of adverse selection and moral hazard. Thus, even if it were intended for the government scheme to break even, losses probably would be incurred. This would make it difficult to justify government sponsorship of student loans on the mere grounds of economic efficiency if there were no positive external effects of education. Efficiency requires that no one is made worse off, but if a loan plan must run at a loss the taxpayers in general are made worse off initially. However, in the long term they may gain because the students will pay higher taxes on the increased earnings received over their lifetimes as a result of the extra education they get under the loan plan, allowing a reduction in general tax rates without a drop in government revenue.[36] Of course, even if there were not an efficiency-based argument in favour of providing student loans, they would be attractive from the standpoint of maintaining social mobility and equality of opportunity.

There is an additional problem which is created by the absence of insurance markets in this context. Suppose adverse selection and moral hazard were not present. If loans were available, but insurance not, the risk-averse student would probably take "too little" education (from an efficiency point of view). Students from lower-income families probably would be most strongly affected (creating inequality of opportunity).[37] The payoff from education may be uncertain. Not only is the individual unsure about his own talents and abilities, but future market conditions in the chosen occupation may be unpredictable. Although there are significant informal mechanisms for reducing such risks,[38] it has been argued both on efficiency and equal opportunity grounds that governments should reduce risk further by providing a student loan scheme with an income-contingent repayment feature.

A number of variants of the income-contingent loan scheme have been

advocated since the proposal was first outlined by Friedman (1955).[39] Typically, it is proposed that student loans should be offered where repayment would consist of a small surtax on personal income, such as 1 percent for every $10,000 borrowed, paid by the student. Such loans could be voluntary, but might be made mandatory to some extent in order to reduce the problem of adverse selection. For example, every university student might be deemed to borrow an amount which represents the current subsidy to tuition, but loans to cover living costs might be voluntary. In some proposals, the income tax surtax would cease for an age cohort when its members had altogether paid back an amount equal to their initial aggregate borrowing.

Another important problem created by the inability of individuals to pool human capital risk with the help of insurance companies is that labour market adjustment processes take on a redistributive character which they otherwise would not have. A contemporary example might be a skilled automotive worker who is to be replaced by a robot; in the absence of compensation from his firm or government, he stands to lose a considerable portion of his remaining lifetime income. With a rapid pace of technological change, this could mean large capital losses to many workers in affected sectors and industries.[40] This loss may be viewed as unacceptable, and under such circumstances, special measures to compensate such workers may be desirable.

Imperfect Competition

The final condition which we indicated was required for optimal provision of education and training by private markets was that all markets should exhibit perfect competition, and in particular those in the education and training sector.

In the absence of government intervention could we expect schools, colleges and universities to exist in a desirable competitive framework? It has been suggested that, in the absence of government, students' and parents' imperfect information might result in a suboptimal average quality of education. The market might end up dominated by bad schools in the same way that the used car market is allegedly dominated by "lemons."[41] Conversely, students and parents may have sufficient ability to monitor the quality of education and training to prevent this being a crippling general problem.

It has also been pointed out that, as a result of the high pecuniary and psychic costs of attending school far from home, schools and colleges have a degree of market power connected with their local "monopoly." The importance of this problem depends on the density of institutions, and the rate at which costs of attendance increase with distance of the institution from home. There is reason to believe that the costs may be significant at many levels of schooling. At the elementary and secondary level, while even small cities are capable of supporting a fair number of

alternative institutions of efficient scale, the psychic costs of attending school outside the neighbourhood may be high. At the college or university level, perhaps only large cities can support alternative institutions of efficient scale.[42] Thus, although psychic costs of attending school at a distance may have gone down, the addition of pecuniary cost caused by opting for a college or university other than the closest may be high.

In view of the problems sketched, in a world with ideal (and costless) government there could be reason for regulation of education to ensure such standards as optimal quality and marginal cost pricing. It is not obvious, however, that actual governments — which incur high costs, and may regulate badly — can produce a net social improvement by regulating education.

A second possible imperfection is monopsony or monopoly power in the market for labour. Most attention is usually devoted to the latter — that is, to the influence of trade unions, which are often regarded as monopoly suppliers of labour.[43] A common view is that unions have some monopoly power and use it to create the union/non-union wage differential. This could conceivably discourage training. If union labour is more expensive, the time cost of training where there is a union is greater. Although it is possible that the benefits of a certain amount of training would also be higher, it is conceivable that workers and employers might find training less profitable in the unionized setting. This is consistent with some evidence that union workers engage in less training than non-union workers with the same characteristics.[44]

It is possible to exaggerate the possible effects of unions on training, however. It is sometimes alleged, for example, that unions impose such high wages for young workers that there is insufficient room for the latter to pay for much training in the form of a gap between potential and actual earnings.[45] This ignores the incentive the union-employer combination has to allocate resources to training in such a way as to maximize revenue for any given level of labour input. It also takes no account of the fact that the existence of the union/non-union wage differential reduces the quit probability from the unionized firm and may therefore make it possible for employers to fund more of specific training[46] and even part of general training.

Another concern with regard to unions is that they may stand in the way of the redeployment and retraining of workers that would be associated with the adoption of radical labour-saving technological changes such as computer-assisted manufacturing and robotics. This is a large and complex issue which cannot be adequately addressed here. However, certain points can be made.

Union workers, and especially older workers who are often believed to have a disproportionate say in union affairs, may be expected to resist technological change if the effect would be to throw some members into unemployment or to reduce earnings. The firm may have to accept that,

when change is introduced, no capital losses in the form of reduced lifetime earnings can be imposed on union workers.[47] This can have two effects. It may prove more profitable not to introduce technological change. However, if potential cost savings are large relative to union workers' "rents," firms may buy out redundant workers by severance payments, and/or by allowing temporary feather-bedding by older workers.[48] Since the cost savings in Canada made possible by such systems as robotics are likely to be large, we may perhaps expect to see the way smoothed by these means for the application of new technology and associated retraining.[49]

Adjustment with Government

In addition to market imperfections which arise naturally, there are a number which occur as a result of the activities of government. These may push education and training to suboptimal levels, or may reduce the speed of adjustment to changes in labour market conditions.

External Effects in the Welfare State

In a society with a restricted government it can be argued that the external benefits of adult training and post-secondary education would be small. However, the welfare state creates important externalities. First, the costs of unemployment and poverty are shared by the community at large because of unemployment insurance benefits and other transfer payments. Hence, if a more highly trained labour force has lower rates of unemployment or poverty, then training should reduce expected future transfers from the rest of society and thus have a social payoff above the private gain.[50] It must be noted, however, that this is a "big if." Those sufficiently capable to undertake university education, for example, would probably experience less unemployment or poverty over their lifetimes as a whole than others, even if they did not go to university. Also, it has been suggested that greater education may be associated with higher earnings not because it increases productivity, but simply because it signals (or screens for) higher ability. If this is the case, we would expect no impact on rates of unemployment or poverty as a result of increasing everyone's education. Everyone would still occupy the same position in the labour force; the only difference would be that it would require more years of education to qualify for a particular job.[51]

Assuming that education and training increase earnings by raising skills, and not just by screening for ability, what forms of training are most likely to produce the externality of reduced unemployment and poverty? It might be argued that university education, since it is directed at higher-ability individuals who would suffer less unemployment and poverty even without a university degree, is likely to have less payoff in

this form than other types of education and training. Leaving aside the schools, we might expect community college, apprenticeship, private vocational school, and manpower training to have a larger impact in reducing unemployment and poverty. This could conceivably justify a reallocation of some of the considerable funds spent to subsidize university education toward these other forms of training. However, more evidence would be required on the relative long-term impacts of these different forms of education before a strong case could be made along these lines.[52]

A second externality associated with the welfare state is created by the progressive taxation of labour income. Under proportional taxation, the externality created by the fact that taxpayers at large benefit by reduced taxation from the increase in earnings resulting from an individual's training is precisely offset by the tax decrease on income foregone in order to undertake human capital investment, assuming that direct costs of schooling are negligible.[53] However, with a progressive tax, private benefits are generally reduced more, proportionally, than costs. If there were no other distortions, the degree of investment would be socially suboptimal.

As pointed out by Boskin (1975), whether human capital investment is forced to a suboptimal level by progressive personal income taxation depends on whether the tax treatment of investment in physical capital is more or less liberal than that of investment in human capital. Corporate income taxes are proportional, and ostensibly allow appropriate expensing of capital costs. However, capital income is subject to the further charges of dividend and capital gains tax under the personal income tax; inflation may lead to an understatement of capital costs; and dividend payments are not allowed as a capital cost. Thus, capital income taxation may place a wedge between the before- and after-tax internal rates of return to investment in physical capital which may be more severe than that created for investment in human capital by progressivity of the personal income tax. Which distortion is more severe is an empirical question that has not been satisfactorily answered.[54]

If the peculiarities of our tax system reduce rates of return on both physical and human capital, it may be a mistake to try to remove the effect for either physical or human capital separately. This will lead to a misallocation of investment between physical and human forms that may create a more severe welfare loss than a situation in which the attractiveness of both forms of investment is reduced equally.[55]

There has unfortunately been little research on the details of how the tax system affects investment in human capital. A preliminary discussion is provided in an appendix to this paper. Some of the results are of considerable interest, despite the fact that we do not know whether the overall stance of the tax system is to encourage too much investment in human capital relative to physical capital. This is because they point out

asymmetries in the treatment of different kinds of human capital investment which it would probably be desirable to correct, irrespective of whether the tax system encourages too much or too little investment in human vs. physical capital.

One central point made in the appendix is that if people undertake small amounts of general training — either on the job or in institutions — foregone earnings costs are implicitly subsidized by the tax system at the worker's marginal tax rate.[56] Hence the subsidy just offsets the taxation of the increased earnings resulting from training. However, for more intensive general training, earnings may fall so much that the implicit subsidy rate becomes much lower than the normal marginal tax rate. In this case, too little subsidy is provided; the worker must bear a larger proportion of the foregone earnings costs of training than he receives of the benefits in increased earnings.

To some extent, the problem of too little implicit subsidy through the tax system for intensive general training is offset by high subsidies to tuition fees. (Note that this only applies to formal education.) However, for successful prime-age workers, the appendix shows, the combined subsidy from reduced income tax and tuition is typically too small to provide a percent subsidy to training costs equal to the marginal tax rate. This provides a possible argument to increase the support given to educational leave for adult workers relative to that given to post-secondary entrants direct from high school.

The appendix also shows that the tax system may have something to do with the apparent reluctance of employers to supply general (transferable) training, as opposed to firm-specific training. One by-product of such reluctance may be reduced training opportunities for women, if it is true that women on average wish more general, relative to specific, training than men.[57] Theory predicts that workers will bear the entire burden of general training — probably in the form of lower wages than would otherwise be observed. Costs of specific training, however, are shared between workers and employers. Under specific training, the employer's training cost is composed of direct expenditures plus the excess of wages over workers' productivity. Both are deductible for corporate tax purposes. Since corporate income tax is at a flat rate, the employer's share of training costs is therefore implicitly subsidized in just the right way to offset the tax on benefits to the firm from the increased future output of the workers as a result of training. Hence, firm-specific training probably is discouraged less by the tax system than is general training.

Minimum Wages

By levying minimum wages, governments create a departure from ideal competitive conditions which it has been claimed may seriously interfere with on-the-job training. The minimum wage puts a ceiling on OJT

because it limits the payment for training which a worker can make via foregone earnings.[58] Estimates by Hashimoto (1982) indicate that the effect may be large: that a 9.6 percent increase in the minimum wage in the United States as a result of the 1967 amendment to the minimum wage law led to a first-round 15 percent decrease in the value of training for young white males.[59]

Against the negative effect on OJT, minimum wages encourage more formal schooling for young people if, as many studies suggest, they reduce employment opportunities for the young.[60] If a young person cannot get a job, the formal schooling option may be chosen even if its payoff in increased future earnings is small. Thus it is conceivable that minimum wages result in more total human capital acquisition by the young than would otherwise occur at the same time that they reduce OJT. Still, this may not be the best way to encourage human capital investment by the young — OJT may often be a much less costly way to impart skills than formal schooling.

It should be pointed out that minimum wages are also set by governments' apprenticeship regulations. The latter commonly specify the wages which apprentices are to earn as a ratio to the wages of journeymen — for example, 40 percent in the first year, 60 percent in the second, and so on. The possible influence of this form of regulation in discouraging apprenticeship training in Canada has not been investigated.[61] This is somewhat surprising, given the frequent complaints about the low scale of apprenticeships in Canada relative to that in many European nations such as West Germany, where apprentices' wages are apparently lower in relation to journeymen's than in Canada.

Effects on Competition

Governments appear to interfere with the optimal provision of education and training by greatly reducing competition in the education and training sector. This is most clearly evident in the public schools. There are many provinces where the only major form of competition is that between public and separate schools.[62] At the post-secondary level there is greater competition. Students may choose from among a large number of institutions which are separately managed, if not autonomous, and which are therefore able to compete effectively to some degree. However, rigid price control in the form of regulation of tuition fees is universal. If the institutions receive a payment from the provincial treasury based on weighted enrolment, there is an additional payment for admitting a student, but this is also outside the institution's control. Hence the price received for admitting a student is the sum of the tuition fee and the grant received from the province. The institution controls neither. Finally, provincial governments control program offerings to a considerable, although varying, extent.

The results of price control in the post-secondary sector would be

expected to be similar to those observed elsewhere — for example, under rent control. Under conditions of rising demand and inflation (which reduces the real value of tuition fees and grants), excess demand builds up and may be dealt with by rationing or by reducing quality (for instance, by increasing student-teacher ratios). Also, when enrolment demand shifts rapidly, as it did toward computer science and engineering in the late 1970s, the response of the system may be disappointing. Up to a point, enrolment can be expanded simply by increasing class size, but this may reduce quality of instruction.[63] It could be difficult to expand further, however, since the boom which creates increased enrolment demand also raises the cost of the chief input — instructional time provided by, for example, computer scientists and engineers.

Slowness of response to increases in enrolment demand can be serious, primarily where the unit cost of producing extra graduates increases rapidly with the scale of operations (as in the computer science and engineering example of the previous paragraph), or when the new demand is in an area where training has not previously been provided. That our post-secondary education system still responds quickly to changes in the structure of enrolment demand when these special difficulties are not present is perhaps suggested by the recent experience discussed in the Post-Secondary Level subsection above. During the 1970s and early 1980s there was a large shift in university enrolment away from faculties such as arts toward business administration and some other professional faculties. Unit costs of producing extra graduates perhaps do not increase as rapidly with the scale of instruction in the short run in an area like business administration as they do in areas like computer science and engineering. In other words, persons who can instruct in business administration may be in more elastic supply in the short run that those in computer science or engineering. This may explain why there were persistent claims that the increase in enrolment in computer science and engineering in the late 1970s and early 1980s was not sufficiently large. Given severe price control, it may have been impossible for the universities to bring in the required additional instructors and other resources without incurring unacceptable losses.

Finally, there is another effect of government on competition in the education sector which does not appear to have been widely appreciated. During the past half-century or so, we have observed a large-scale shift in the provision of many forms of training from firms to colleges and universities. Accountants, lawyers, engineers, journalists, nurses, and members of many other occupations now receive a great deal of education at universities which they previously obtained on the job. Similarly, training for many blue-collar occupations now occurs largely in colleges instead of on the job. In fact, colleges as we know them now did not exist prior to the 1960s. To a large extent, the training they now provide must have been obtained previously on the job. One consequence of this shift

is that we now provide many forms of education and training in the heavily controlled, imperfectly competitive, and perhaps slow-to-adjust public post-secondary system, instead of in competitive firms. Thus, the responsiveness of our overall education and training system may have fallen during the past half-century or so, even if the post-secondary system is no less responsive.

Policy Conclusions

The foregoing discussion suggests some policy conclusions. These concern the need for an overall increase or reduction in government support for education and training; the advisability of reallocation of government support among different forms of education and training; the need for increased competitiveness and enrolment-demand responsiveness throughout the formal education sector; and the appropriate strategy for dealing with the reeducation and retraining apparently necessitated by adjustment to current technological change.

Overall Scale of Government Support and the New Technology

It is beyond the scope of this study to assess whether the current overall scale of support for education and training by government is of the right size. While some features of the tax system discourage investment in human capital, and some students and trainees still have difficulty in financing their studies, there are in total very large subsidies to education and training. It is conceivable that the overall result of government action is to encourage too much investment in education and training relative to that in physical capital. This is an issue which requires much more extensive examination.[64]

While it is hard to judge the right level of overall public support for education and training, some might suggest we can see in which direction that optimal level is currently changing. There is a popular belief that we need more and better education and training to help us accommodate, and profit from, the new technology. We are seeing something of a rebirth of the enthusiasm for education and training which characterized the 1950s and early 1960s, and which was based largely on a belief that increased government spending in this area was necessary to keep the engine of growth running satisfactorily.[65]

The notion that greatly increased expenditure on education and training is necessary in reaction to current technological change is connected with the view that, ideally, much of future employment growth will be accounted for by highly skilled and specialized occupations such as computer programming, systems analysis and computer engineering. In

this scenario, in order for Canadians to achieve the wealth made possible by the new technology and to avoid an increase in unemployment and poverty because of a growth in the proportion of the labour force without valuable skills, it would be necessary to have education and training of much-increased quality, and perhaps also of increased average duration. Without a radical change in the way we finance education and training, this would mean a sizeable increase in government expenditure.[66]

In fact, there is considerable uncertainty about the employment effects of the introduction of new technology during the next 10 to 15 years.[67] To understand why this is the case, consider in turn the impact of new technology, first, in those industries and sectors where the technology of production is likely to change most, such as in office work, manufacturing and trade, and, second, in other industries.

Available research indicates it is not clear that the average skill content of jobs in industries where the new technology will be most intensively adopted will increase. Technological change often has a deskilling effect (see Globerman, 1985). The skilled craftsman formerly required may be replaced by someone who merely knows which buttons to press. Or, as Selleck (1983, p. 17) points out, "The supermarket clerk passing encoded grocery products across an optical scanner is a prime example of the deskilling effect of microtechnology. . . ." The conclusion is that the average education/training requirement for workers going into the industries where technological change is concentrated may well decline, rather than increase.[68]

If educational requirements for industries using the new technology most heavily on average do not rise, we would expect an overall need for increased education and training only if there is a shift in employment from those industries to others, and the industries experiencing less technological change have a higher education/training requirement. It does not appear that the latter condition will be met.

To which occupations and industries will the new technology be most heavily applied, and where is the scope for this application limited? In the former category we have almost all office work, much of manufacturing, financial services, communications, and perhaps wholesale and retail trade.[69] Employment may perhaps be expected to shift from these areas to personal services such as provision of restaurant meals, health care resulting from the aging of the population, construction and leisure industries. While some of the destination areas for employment such as health care may have a fairly high average educational requirement, it is far from obvious that the average educational requirement is higher. In fact, it may be less.[70]

In conclusion, the argument that the appropriate overall scale of support for education and training is rapidly increasing because of technological change appears weak. This is not to say that nothing needs

to be done in the field of education and training to react to the new technology. Appropriate responses are discussed below.

Reallocation of Government Support

Because of the changes in the future structure of demand for labour occasioned by the new technology, demographic change, rising real incomes and so on, there will be major and perhaps continuous changes required in what is taught in our schools, colleges, and universities; in relative enrolments in different fields; and in the nature of on-the-job training. Some of the required changes are not too hard to perceive. For example, it is clear that basic computer literacy needs to be fostered in the schools and more medical personnel will have to be trained in the future. But careful study would be required before providing more detailed advice on whether we really need to produce more engineers or increase graduate enrolment in the sciences. Our best strategy may be not to try even to answer such questions. Greater reliance on the market mechanism to determine the allocation of educational resources would lead to a situation where resources would be reallocated as required by changing patterns of demand without central coordination.

Methods of using the market mechanism more extensively to direct the allocation of resources in education and training are considered in the next subsection. Here we can identify some basic distortions affecting human capital investment decisions which are created by governments. Removal of these distortions would result in desirable reallocation of resources in education and training — both privately and publicly funded.

The discussion in the section Adjustment with Government pointed out certain asymmetries in government support for different forms of education and training in different age groups. These asymmetries, which distort the pattern of investment in human capital, are not widely appreciated. This is partly because they are to an extent created by implicit subsidies in the form of a decline in taxes when income falls during education or training. We are not accustomed to pay much attention to such implicit subsidies.

Young Workers

Consider the situation of young people. Those who enter post-secondary institutions receive a high rate of subsidy on direct costs such as tuition, and a low rate of subsidy on foregone earnings. (They would have been in relatively low tax brackets if they had not continued in formal schooling.) The net result is a rate of subsidy which probably just about offsets the depressing effect of the increase in future tax burden associated with expected increase in future earnings as a result of their

future education (see the calculations in the appendix). In contrast, the great majority of young workers enter the labour force immediately after high school, are not involved in apprenticeship or other government-sponsored programs, and do not receive any explicit subsidy to training costs. All they receive is the implicit subsidy in the form of no taxes on foregone earnings. (Recall that according to human capital theory, these workers pay for part of their training in the form of lower wages on foregone earnings.) Since this subsidy is at a rate much lower than that on post-secondary tuition undertaken by college and university students, young workers directly entering the labour force are discouraged from training. This effect is reinforced by the limit, caused by minimum wage laws, on the amount of training for which young workers can pay via foregone earnings.

To an extent, both federal and provincial governments have already responded to this problem. Mostly because of provincial initiatives, real per student expenditures at the post-secondary level have been declining, and there has been an expansion of wage subsidy plans to help young people get jobs. Also, under the National Training Program (NTP), the federal government has continued to increase the scale of support to industrial and apprenticeship training (some of which goes to young labour force entrants), and has for the first time allowed school-leavers to enter non-apprenticeship manpower training directly, that is, without first spending a year in the labour force. However, the great majority of those entering the labour force directly from school still receive no government assistance in obtaining OJT.

Possible responses to the problem of inadequate encouragement for on-the-job training for school-leavers include strengthening programs already in existence — expanding apprenticeship if practicable, encouraging more participation in institutional manpower training by school-leavers, and spending more on "career action" wage subsidy-type programs. To an extent, this would sidestep the problem, because institutional manpower training would substitute formal education for the perhaps more productive on-the-job training. Also, the approach is selective: a minority of school-leavers receive intensive assistance, but the majority continue without help. In addition to inequity, this raises the danger that government assistance would encourage young people to crowd into high-demand occupations when actually a greater spreading-out might be desirable.

In view of the drawbacks of selective support for vocational training of school-leavers, it may be desirable to consider a universal approach. Examples of the latter are provided by the West German system, under which all those not in ordinary schools or post-secondary institutions between the ages of 15 and 18 are required to be involved in some kind of vocational training, part being provided by the state in the form of institutional training and part being offered by firms in the form of apprenticeship

(Prais, 1981, chap. 4). Less ambitious schemes exist in other European countries.[71] These schemes have their attractions. They may, for example, reduce the need for remedial manpower training, on which we spend so much in Canada, by getting people trained properly in the first place. However, they are unquestionably very expensive. Less costly alternatives might therefore be considered.

One universal and administratively cheap proposal would be to offer wage subsidies inversely related to age for all young workers — for example, $1.50 per hour for those aged 16 to 18 and $1.00 per hour for those 19 to 20.[72] It will be argued by some that this would just lead to an expansion in dead-end jobs for the young, because of the lack of a required training component in the jobs subsidized. Some of the subsidy would no doubt go to support such jobs, but this has to be weighed against the benefits of the scheme, including reduced youth unemployment as well as greater OJT, and the considerable cost of enforcing standards. If the minimum wage is severely reducing OJT for workers in the target age brackets, then the subsidy creates critical room for the intensity of training to increase.

As an example of the possible impact on OJT of a wage subsidy for young workers, consider the situation of a 17-year-old who can produce output worth $4.00 per hour in the absence of training. Suppose this worker would like to spend half the on-the-job time acquiring general skills.[73] If the employer allowed this, he would have to pay a wage of $2.00 an hour to avoid making a loss. But if the minimum wage is $3.00, this arrangement is not possible. Quarter-time training with wages of $3.00 and foregone earnings of $1.00 is the maximum that can be allowed. Now, if a wage subsidy of $1.00 per hour is provided to the employer, the wage of $3.00 an hour can be paid *and* half-time training allowed; the worker only produces $2.00 worth of output, but the employer receives another dollar from the government, so that the net payment for labour services equals the value of marginal product.[74]

There are potential pitfalls in reallocating government support from post-secondary education toward vocational and/or on-the-job training for school leavers. Such a reallocation could result in higher tuition fees at the colleges and universities, thereby making it more difficult for young people from low-income families to attend post-secondary institutions and reducing equality of opportunity. It might even be feared that streaming would occur of children from low-income families into vocational and on-the-job training, and children from high-income families into post-secondary institutions.

Concerns about possible effects on equality of opportunity of reducing support for the post-secondary system are not entirely misplaced. However, it should be pointed out that, given the disproportionate use of post-secondary services by children from middle- and higher-income families, the distributional implications are not undesirable. To an

extent, increased inequality of opportunity can be avoided by increasing the limits on amounts which can be borrowed under the Canada Student Loan Plan (CSLP) in line with observed increases in tuition fees. Whether an income-contingent repayment feature in the CSLP is also required is a question addressed below.

Prime-Age Workers

The relative rates of subsidy to formal schooling and the proportion of OJT paid for by workers change with age. Older workers have higher wage rates, so that when a typical prime-age worker[75] goes back to school full time, for example, direct costs such as tuition are typically quite small in relation to foregone earnings. Thus the high rate of subsidy to direct costs is not as important as for school-leavers; the major factor is that the rate of subsidy to foregone earnings via reduced personal income tax liability will be lower than the worker's normal marginal tax rate. A similar problem is experienced by part-time post-secondary students. Since what they forego is typically hometime rather than worktime, they receive little implicit subsidy via the tax system.

In contrast to prime-age workers in formal schooling, workers obtaining OJT receive a subsidy to their foregone earnings costs not much lower than the tax rate that will apply to the increased earnings that are the result of training. This is because their foregone earnings are typically a small or moderate fraction of potential earnings, so that the tax reduction on foregone earnings is at a rate not much below their normal marginal tax rate.

Action to redress the balance for prime-age workers between OJT and formal schooling has so far consisted mainly of making more courses accessible on a part-time basis, and the recent extension of Canada Student Loans to part-time students. Current proposals for paid educational leave constitute a radical further response.

Increasing Competitiveness

There are grounds for concern over the responsiveness of our schools, colleges, and universities to changes in the structure of the demand for education and training. This problem is to be expected because the element of competition between institutions appears low in the school systems of most provinces, and, while stronger at the post-secondary level, has been significantly eroded there. To an economist it seems clear that educational institutions, like other agents in the economy, must be given appropriate incentives to respond to changes in demand. If not faced with the threat of students flocking to alternative institutions (and the carrot of attracting such flocks themselves), the main forces inducing educators to be responsive will be their altruism and magnanimity and/or the fear of adverse consequences via the political mechanism.

While educators' sense of responsibility, and the threat of action by government, may induce considerable enrolment demand responsiveness, they may work more slowly than the discipline of market forces, and also may fail in critical ways. For example, in a period of rapidly changing technology, demands for workers in new and highly specialized occupations may emerge. Politicians, the public, and administrators may be unaware of many of these opportunities. Under these circumstances, the capacity of institutions to respond to the new needs may be too weak. There may also be a tendency to make the adjustments which the public can easily monitor — for example, greatly expanding enrolments in areas of high demand — while sacrificing quality or neglecting other dimensions of service which are hard for the public to observe.

At the elementary and secondary levels, a great increase in competition would seem to have a large potential payoff. Greater competition could be produced by a voucher or tuition fee tax credit scheme.[76] Accreditation of a wide range of private as well as public schools could be implemented. The Independent Schools Support Act in British Columbia represents a good initial approximation to this ideal. However, it provides a much lower subsidy for private tuition than is given to the public schools.

The situation at the post-secondary level may be more complex. Here there are frequent claims of gross unresponsiveness to enrolment demand, but the figures indicate the opposite: there have been large-scale changes in the structure of full-time university enrolment over the last 10 or 20 years, for example. This is in line with the increasing demand for business graduates, and reduced demand for arts graduates and teachers. At the same time, there are fears that although quantity responses have been in the right direction, they have not been strong enough, or have sometimes been accomplished by reductions in quality such as increases in class size. The overall quality of post-secondary instruction may be declining because of government spending restraints and the tight control of other sources of finance, mainly tuition fees. In addition, it can be pointed out that the responsiveness during the past 10 or 20 years occurred during a period when post-secondary enrolment was generally rising at a good rate and, until recently, funding expanded in most provinces at a reasonable rate. Maintaining responsiveness to shifts in demand may be much more difficult if overall enrolment, and government support, are declining.[77]

In view of these concerns, it appears appropriate to consider ways of reversing the increasing rigidities in the financing of post-secondary institutions that have been imposed by provincial governments in recent years, and to encourage greater competition between post-secondary institutions. Provincial governments could increase competitiveness in the post-secondary sector by loosening their control of tuition fees and

by ensuring that a sizeable portion of support for post-secondary institutions would come in the form of subsidies directly related to enrolment.[78]

The most important effect of freeing-up tuition fees would be to induce much greater enrolment-demand responsiveness. Another consequence could be a considerable increase in average fees. As in any situation where a price has been held fixed at an artificially low level, removal of controls probably would produce an increase in price. Fees would have an added tendency to increase if students demanded a higher quality of instruction. It seems possible that today's post-secondary students would be willing to pay more than they do at present in order to benefit from smaller classes and innovations such as computer-assisted learning. These increases in fees would erode equality of access to post-secondary education if countervailing action were not taken, such as an increase in the borrowing limits under CSLP.

Another consequence of giving institutions greater control over fees could be the emergence of greater variation across programs and among institutions in fees, reflecting differences in costs and in quality. Low-cost, no-frills education might be offered by some institutions, while others would provide more intensive, higher-quality education aiming at excellence. In short, a much more heterogeneous post-secondary system, efficiently serving the highly varied needs of different kinds of post-secondary students, could emerge as a result of decontrol of tuition fees.[79]

Unilateral action by a provincial government to allow an increase in tuition fees would doubtless be unpopular. We must therefore look to cooperative efforts by the provinces and the federal government, or action at the federal level alone, to achieve freer tuition fees.

The main element in federal support for post-secondary education is represented by the lump-sum Established Programs Financing (EPF) grants under the Fiscal Arrangements Act of 1977. The Dodge Report suggested that these grants should be reduced, with funds diverted partly to vocational training but also to other areas including student aid and special initiatives to fund start-up costs for new programs in the post-secondary sector. Larger amounts of student aid should be made available for those entering programs deemed to be in high demand, the report maintained.

While discretionary federal support to programs deemed to be in areas of high demand has inherent risks — forecasting the occupations that will be in high demand when graduates come out of the educational pipeline is notoriously difficult — there is much to be said for the strategy of channeling federal support to post-secondary education through students rather than through provincial governments.

Because of constitutional and other constraints, it appears that the federal government would have little success in attempting to induce the

provinces to dispense EPF funds to post-secondary institutions in a manner more closely related to enrolment. However, this problem might be overcome by giving funds to students instead of governments. By putting cash in a student's hands, the federal government would direct its support to the programs that students demand. Provinces would be able to allow tuition fee increases without incurring the displeasure of the electorate, giving post-secondary institutions the flexibility to respond effectively to enrolment demand. Finally, as Kesselman (1983) has pointed out, if students were required to shoulder a larger share of the cost of post-secondary education (as implied by the notion of reallocating support to vocational and on-the-job training), they could be expected to choose their post-secondary programs very carefully. Hence, the changes in allocation of resources induced by shifts in student demand should be appropriate.[80]

If total expenditures in support of post-secondary education were to be reduced, what form should accompanying increased direct federal support to students take? It has been suggested (e.g., Stager, 1981; Kesselman, 1983) that, in order to keep costs down, additional support should be provided in the form of much larger student loans with an income-contingent repayment feature. This would have the advantages of counteracting the effect of risk aversion on human capital investment, and should help to maintain equality of opportunity.

Unfortunately, large-scale use of the contingent repayment scheme is unlikely to be popular.[81] The surtax imposed on graduates would be highly visible, and might widely be felt unfair. The direct connection between loans and repayments under the CSLP would no longer hold. In place of a proper loan with a chartered bank, an individual would have a seemingly arbitrary increase in lifetime income-tax liability. This extra liability would be computed by applying a formula which often might not be widely understood. Individuals with relatively good earnings experience would correctly perceive that they were more than repaying their "loans." Resentment toward those with lower earnings and repayment might therefore be strong.[82] Finally, if taking out a "loan" was to an extent optional, students from lower-income backgrounds would probably borrow and repay more than students with equivalent lifetime earnings but who had the advantage of coming from wealthier families.

The unpopularity of income-contingent repayment might have the adverse impact of preventing the provinces from allowing tuition fees to increase very much. Thus, one of the goals of switching federal funding from lump-sum EPF payments toward direct assistance for students would not be achieved.

A more attractive option might be for the federal government to increase considerably the loan limits under a basically unchanged CSLP and institute a partial tuition fee and educational expense tax credit. Some fraction of the direct costs of formal schooling could be allowed as

a tax credit up to some ceiling.[83] This would be equivalent to making cash grants to students differentiated according to program costs, assuming not all students obtained the maximum credit. An educational expense tax credit would accomplish the goal of switching federal support for post-secondary education from lump-sum EPF grants to direct aid to the students in such a way that provinces would have an incentive to respond by increasing tuition fees. Each increase in tuition fees could be largely offset by increased federal aid to students.[84] By pointing this out, a province ought to get ready agreement from its electorate in favour of a tuition increase.

In sum, appropriate policy for the federal government would be as follows. It should first terminate all subsidies to support the teaching function of post-secondary institutions via provincial governments. Some of the funds thereby saved should be redirected into increased support for vocational and on-the-job training for young school-leavers not going on to post-secondary education. The rest should be provided to post-secondary students partly in the form of a tuition fee and partly as an educational tax credit. Finally, the possible increase in educational costs to students over and above that covered by the educational expense tax credit should be accommodated by increasing the ceiling on borrowing under the Canada Student Loan Plan.[85]

Retraining and Paid Educational Leave

The tax system provides more liberal treatment for on-the-job training than for part-time or full-time formal education for prime-age workers. Given stable technology and stable patterns of demand, this imbalance might be of little concern. After concentrating completely in formal education in initial years, individuals would acquire general and specific skills through on-the-job training. The time devoted to such training would decline until, by late middle age, workers would be engaged almost entirely in earning a return on their accumulated skills, and would spend little time augmenting skills further. Whether taxes and subsidies for high-earning prime-age workers discouraged formal education relative to OJT would be of little concern. In any case, few prime-age workers would want to return to formal schooling.

In fact, changes in technology and the structure of demand necessitate retraining and reeducation at various points in an individual's lifetime. Changes in demand can wipe out the value of a worker's skills, or can create new opportunities for human capital investment which were not present initially. Provided a worker is not too old, such changes will often make a period of increased human capital acquisition a paying proposition. They may even make profitable full-time return to study.

It is widely expected that the structure of occupational demand and skills in the labour force will change fairly rapidly over the next few

decades. If this expectation is accurate, how the tax system, loan plans, and educational subsidies affect reeducation and retraining are matters of legitimate concern. It should be noted, however, that there is no strong evidence that we have already begun to experience the kind of severe changes in occupational demand and skills that have been so widely anticipated (see, e.g. Selleck, 1983).

Do recent proposals of methods to encourage reeducation and retraining in Canada suggest appropriate instruments for correcting current treatment of different kinds of education and training for prime-age workers? The two main proposals of interest are a levy-grant scheme of the type used for a while in Britain in the 1960s and 1970s, and the proposal for earned educational leave made recently in *Learning for Life*.

While there are strong proponents of a levy-grant scheme, it has been rejected both by the Dodge Report and the national advisory panel of the Skill Development Leave Task Force. It appears to have been advocated on the basis of an important misconception. It is argued that firms will not supply general training because they cannot reap a return from such an investment; if they attempt to do so, workers will be "poached" by other firms. It is correct that firms cannot invest in a worker's general training for this reason. The conclusion, however, is not that such training will not take place, but that the worker must pay for it in the form of a lower wage than would otherwise be earned.

If there is a problem in the provision of general on-the-job training, it may be that wage floors are sometimes too high to allow appropriate amounts of training.[86] Such a situation could be created by minimum wage laws or poor collective bargaining. In either case, a levy-grant scheme could, in principle, offset the effects of the wage floor. The employer pays a tax based on his overall payroll and receives grants (perhaps from an Industrial Training Board composed of union, employer, and government representatives, on the British model) for approved training programs, which could include institutional training or post-secondary education. These grants can make room for training additional to that paid for by the worker.

If unions and employers really sign contracts under which young workers' wages are too high to allow them to pay for training in the form of foregone earnings, industry perhaps deserves to be burdened with a levy-grant scheme! However, it seems more likely that collective bargaining works better than this, and that the primary problem to be addressed by the levy-grant scheme would be that created by inappropriately high minimum wages for young workers. In that case, the rationale for financing training grants by taxing employers is no longer present. The levy aspect of the levy-grant scheme would be without justification.

Some of the probable economic effects of the levy-grant scheme do not appear to be widely understood. The levy constitutes a tax on labour

inputs. In equilibrium, this would be passed on by employers to the workers themselves, in the form of lower wages; to owners of capital, through lower returns on equity and debt; and to consumers, in the form of higher prices. The overall demand for labour would fall — probably producing more unemployment, with most serious effects in labour-intensive industries where the increase in costs would be greatest as a result of the tax. Prices of goods produced in the most labour-intensive industries would rise relative to those of other goods, with a resulting shift in demand toward other sectors. These do not seem like particularly desirable effects.

The other major proposal for support of reeducation and retraining is the earned educational leave proposal of the Skill Development Leave Task Force national advisory panel, set out in *Learning for Life*. This would provide every worker with the right to paid educational leave at the rate of one day off for every 30 days worked.[87]

The earned-time-off proposal in *Learning for Life* offers high rates of subsidy for a short period of time. For example, after five years of work, about two months off would have been earned. For workers whose reeducation opportunities are good, this will not allow enough time off, while for those with bad opportunities it will allow too much. Efficiency suggests that it would be preferable to have a scheme under which reeducation would be subsidized at a rate comparable to that at which increased future earnings would probably be taxed, without imposing any limit on how much educational leave could be taken. Under such a scheme, those with good reeducation opportunities would return to school long enough to exploit their opportunities properly, and those for whom reeducation would be a poor investment would remain on the job.

In fact, an attractive alternative to the earned-time-off option has already been proposed. This is the Registered Education and Training Savings Plan of the Dodge Report, or Registered Educational Leave Savings Plan of the Skill Development Leave Task Force report. Under the RELSP, workers could save for reeducation in the same way that first-time home-buyers can now save for a house. Each year, contributions up to some limit could be used to reduce taxable income, with resulting tax relief. Then, when the individual took time off to go back to school, the contents of the RELSP could be withdrawn tax-free and spent on direct and indirect education, including both vocational training as well as post-secondary education.[88]

The RELSP would provide approximately the right rate of subsidy to give prime-age workers symmetric treatment between formal education and on-the-job training. Assume that the amounts accumulated in an RELSP are eventually spent completely on schooling. Then the educational costs thereby financed are implicitly subsidized at an "average" of the marginal tax rates the individual faced when saving. This average subsidy rate would typically be close to the tax rate the individual would

have to pay on the increased future earnings resulting from reeducation.[89]

A possible objection to the RELSP approach is that reeducation opportunities may arise quite suddenly, and individuals who could profit from going back to school often would not have accumulated the required RELSP reserve. This could be handled quite easily by allowing workers on educational leave to borrow against an RELSP account. They would accumulate RELSP debt over the course of their leave, which they could pay back in a tax-assisted fashion in just the same way that others accumulated RELSP accounts prior to educational leave. That is, each year (up to some limit) repayments could be made and deducted from taxable income. Reduced future tax payments would be used to finance current reeducation.[90]

A second objection to RELSPs might be that, unlike the earned-time-off approach, they would not compel employers to grant time off for reeducation. Many employers might not allow time off for further education under the proposal I have made. But from an efficiency point of view this is probably an advantage. What has been ignored in the *Learning for Life* earned-time-off proposal is that employers typically have a large investment in prime-age workers' specific human capital. Educational leave threatens that investment on two counts; first, no return is earned on the specific capital while the worker is away; and second, the worker accumulates general human capital while on leave, which increases his market value elsewhere and this raises the likelihood of a future quit.

If the RELSP proposal were to be implemented and we were to observe employers frequently disallowing educational leave, then this would indicate that the benefit of educational leave in the form of increased general human capital was exceeded by the expected loss of specific capital. Under this system, workers could sign contracts committing themselves to return to the firm after educational leave for some period at a predetermined salary set low enough to compensate the firm for the loss of specific capital services during the leave and expected cost from leave-induced quits. If a firm and a worker failed to agree on a leave package, this would indicate that the compensation required by the employer, in the form of a low salary on return, was greater than the expected benefits to the employee. (Note that competition among employers should prevent the compensation asked by the employer exceeding the true expected cost to him of the educational leave.) Thus the employer's "refusal" to allow educational leave would be efficient.

There appear to be advantages to Registered Educational Leave Savings Plans in comparison with the earned-time-off, paid-educational-leave proposal advocated in *Learning for Life*. RELSPs deserve closer attention as a possible device for increasing the incentives for prime-age workers to return to formal schooling instead of training on the job. It would be unfortunate if we were to adopt an expensive proposal which

would engender a considerable amount of wasteful paid educational leave instead of encouraging optimal educational leave for those who could make best use of it.

Appendix: Effects of the Tax System on the Structure of Investment in Human Capital

This appendix considers in more detail the possible impact of the Canadian personal and corporate income taxes on the structure of investment in human capital. It deals first with the impact on general training, undertaken either on the job or in an institution, and then compares the impact on general versus specific on-the-job training.

General Training

Theory gives strong reason to believe that general ("transferable") training will normally be financed by individuals, with no help from employers. General on-the-job training is therefore paid for by the worker in the form of a lower wage than would be received without training.

For small amounts of general training, ignoring tuition fees and other out-of-pocket expenses, the tax system reduces both the future benefits (increased earnings) and present cost (foregone earnings) by the same percentage — that given by the worker's marginal tax rate. It is only when the amount of training is large that a problem is created. Training may push future earnings into a higher tax bracket, increasing the tax rate on the benefits from training above the original marginal tax rate. In addition, foregone earnings may be large enough to push the worker into a lower current tax bracket, reducing the rate of implicit subsidy on training costs due to the tax system. In the extreme, when the worker specializes completely in training — that is, where he goes back to school full-time — the percentage rate of subsidy on foregone earnings costs becomes equal to the average tax rate that would be paid on full potential current earnings.[91] Benefits of training are therefore taxed (initially) at the marginal tax rate the individual would face if earning full potential earnings, whereas costs are subsidized at the average tax rate (ignoring subsidies to tuition fees, examined below). Average tax rates are considerably below marginal rates for most taxpayers, so that discouragement of human capital investment may be significant.

Thus the tax system provides just the right subsidy to encourage people to undertake training that produces the externality of increased future tax revenue when the amount of training is small. (Recall that we are assuming investment in physical capital is not discouraged by the tax

system.) However, it may be efficient for workers to take large amounts of training. This is certainly true for young people, who initially specialize almost completely in training, as well as older workers for whom intensive retraining would produce a large gain in earnings.[92] In these cases, the tax system does not provide a sufficient subsidy.

In order to see what other asymmetries in general training are created by the tax system, consider the following equation determining the overall rate of subsidy, s, on the total costs, TC, of education where we recognize that TC is composed of both foregone earnings, FE, and direct costs, DC (tuition fees, etc.):

$$s = t \cdot \frac{FE}{TC} + s_{DC} \frac{DC}{TC} \tag{1}$$

Here t represents the tax rate of FE, while s_{DC} is the rate of subsidy to direct training costs.

In order to see the implications of (1) for the optimality of investment in human capital, it is necessary to see how s compares with the tax rate on the increment to future earnings, which may be approximated by the current marginal tax rate on potential earnings $= m$. Now, it is likely the case that for almost all taxpayers $s_{DC} > m$. Under the 1982 tax schedule, for example, the marginal tax rate for the representative taxpayer in the \$50,000 to \$60,000 range of taxable income was 44 percent (assuming Ontario rates for provincial income tax). Although rates of subsidy to post-secondary instruction may often be exaggerated, it is probable that they are at least 50 percent. Since $t < m$ we likely have:

$$s_{DC} > m > t \tag{2}$$

Under (2) it is not difficult to see that variations in FE have a large impact on the size of the overall subsidy rate s in relation to the marginal tax rate m. For those with $FE = 0$, for example, $s = s_{DC} > m$ and investment in human capital is actually overencouraged. $FE = 0$ of course is not very realistic. As FE rises above zero, more weight is placed on t and less on s_{DC} in (1). (We may assume without too much loss of realism that DC and s_{DC} do not vary — they probably vary less than FE across individuals.) The result is that s will get closer and closer to t as FE rises. Since $t < m$ it therefore becomes more likely that the overall rate of subsidy will be too low.

Appendix Table 5-A1 gives some indication of the possible severity of these problems. It assumes DC = \$3,000 and \$4,500 alternatively, and that the student pays \$1,500 of this direct cost in both cases. The values of t and m are taken from the actual 1982 tax results. The table indicates that overall rates of subsidy are initially above the marginal tax rate on earnings, when foregone earnings are low, as expected. The rate of subsidy then declines for a while, as FE increases under the influence of the reduced weight placed on s_{DC} in (1). Beyond some point, however, a

APPENDIX TABLE 5-A1 Hypothetical Rates of Subsidy to Post-Secondary Education in Ontario, 1982, for Full-Time, Full-Year Students

			DC=\$3,000, s_{DC}=0.5		DC=\$4,500, s_{DC}=0.667	
FE	*t*	*m*	*s*	*m* − *s*	*s*	*m* − *s*
$	0	0	.5	−.5	.667	−.667
5,250	.002	.234	.183	.051	.309	−.075
10,240	.069	.263	.167	.096	.252	.011
15,250	.116	.277	.179	.098	.242	.035
20,250	.143	.292	.189	.103	.238	.054
31,200	.178	.365	.206	.159	.240	.125
42,250	.205	.438	.225	.213	.249	.189
54,360	.221	.438	.262	.176	.255	.183

Source: Author's calculations. t is from Revenue Canada, *Taxation Statistics*, 1983 ed., Table 2, and m is from the same source, p. 286.

Notes:
FE = foregone earnings
t = average tax rate
m = marginal tax rate
DC = direct cost of education
s_{DC} = subsidy rate on DC
s = subsidy rate on total cost, TC ($TC = FE + DC$).

Taxes here include the federal and Ontario personal income taxes. The latter equals 46 percent of the former. Other provinces levy personal income tax at rates varying from about 39 percent to 58 percent of the federal tax.

combination of rising t and an increasing weight on t in (1) results in an increase in the total subsidy rate. But this increase is not very rapid, and under either the $DC = \$3{,}000$ or $DC = \$4{,}500$ assumption the gap $m - s$ increases monotonically as long as m is still rising.

Appendix Table 5-A1 thus shows that the tax system discourages a return to full-time study more severely the higher are foregone earnings. This means that older workers are discouraged from going to college or university relative to younger (because their foregone earnings are higher, other things being equal), and higher earning persons — perhaps more highly skilled and educated workers — in any age group are discouraged from full-time study relative to lower earning persons. This suggests a possible rationale for subsidies to educational leave, which would benefit mostly prime-age workers with permanent labour force attachment. (Note, however, that if paid educational leave raised s to 1.0, say, for simplicity, for all prime-age workers, $m - s$ would still be largest for the highest earning workers so that, relative to lower earning workers, there would be less encouragement to return to school.) The advisability of raising s this high — as implied by some paid educational leave proposals — is discussed in the section on policy conclusions.

We already, of course, have some differentiation of student financial aid according to foregone earnings. The Canada Student Loan Plan and provincial programs to support undergraduates are means tested, for example. Foregone earnings of post-secondary students are likely positively correlated with means, since both are related to family background. This suggests an inappropriate (from an efficiency point of view) extra subsidy to those with the lowest foregone earnings. At the same time, the high support to graduate students, whose foregone earnings are generally quite high for their age group, can perhaps be justified on the grounds of trying to close the $m - s$ gap.

General and Specific On-the-Job Training

While general training will be financed wholly by individuals, it is predicted that training in skills specific to a firm will be paid for partly by workers and partly by employers. There arises an interesting difference in the tax treatment of general and specific training which may have something to do with the repeated observation that firms are reluctant to supply general training.

Except where government programs provide explicit training subsidies, general OJT is paid for by workers entirely in the form of foregone earnings. The only assistance the worker receives is in the form of the reduced personal income-tax payments which result. Specific OJT, however, receives more generous treatment. Suppose the worker spends half his time training and the firm picks up half the costs. Half the reduction in the worker's output is paid for in a reduction in his wage, giving no net tax consequences for the firm (costs fall as much as revenue). The other half of the reduction in output, however, leads to a reduction in corporate tax since there is no reduction in the firm's costs offsetting the fall in revenue. Hence the employer's portion of costs of specific OJT are subsidized at the corporate tax rate — approximately 50 percent. This more favourable tax treatment of specific OJT might help to explain the frequent observation that firms are reluctant to supply general OJT.

Notes

This study was completed in November 1984.

Acronyms have been used extensively in this paper to refer to various government units and programs. A list follows of those used most often.

BTSD	Basic Training for Skill Development
CEIC	Canada Employment and Immigration Commission (formerly, Department of Manpower and Immigration)
CMITP	Canadian Manpower Industrial Training Program
CMTP	Canada Manpower Training Program
CSLP	Canada Student Loan Plan
COPS	Canadian Occupational Projection System
CTST	Critical Trades Skill Training
EPF	Established Programs Financing, Fiscal Arrangements Act, 1977
GIT	General Industrial Training
HQM	Highly Qualified Manpower
NTP	National Training Program
OJT	On-the-Job Training
OCAP	Ontario Career Action Program
OTIP	Ontario Training Incentive Program
RELP	Registered Educational Leave Plan
RELSP	Registered Educational Leave Savings Plan
RETSP	Registered Education and Training Savings Plan

1. For details of the B.C. system, introduced under the Independent Schools Support Act of 1977, see Wilson and Lazerson (1981).
2. Ontario, for example, has started to implement plans to increase the required number of courses in the high school curriculum, placing greater emphasis on mathematics and English, and is making guidance teaching compulsory from grade 7 through all levels of high school. See "Tougher High School System on Way," *London Free Press*, November 30, 1982, p. 1.
3. Davies and MacDonald (1984, Table 12, p. 109) shows that in the 1960–61 school year for Canada as a whole, per student operating expenditures in the schools were at $343 (in 1971 dollars), just 16 percent of the figure for the universities; by 1980 – 81 the per student spending in the schools had risen to $1,217 (in 1971 dollars), or 29 percent of the figure for universities.
4. These figures, and others on enrolments and expenditures throughout the paper, are from Statistics Canada, *Education in Canada*, Publication No. 81-229, various issues, unless otherwise stated.
5. A good reference on these changes in Leslie (1980). See especially pp. 146–59 on changes in the structure of federal support. See also Davies and MacDonald (1984, chap. 5).
6. Under the Technical and Vocational Training Assistance Act (TVTA) of 1960, community colleges had already begun to receive matching grants. This led to very rapid growth, especially in Quebec. See Weiermair (1984, pp. 17–19).
7. When the Fiscal Arrangements Act was amended in 1982, EPF was carried forward for the period 1982 – 87 largely unchanged. A small decrease in transfers in the form of the termination of the "revenue guarantee" (introduced in 1972) and restrictions under the "6-and-5" program made room for a liberalization of the Canada Student Loan Plan (CSLP).
8. Public awareness of this responsiveness appears to have been slight. A possible reflection of this general perception of unresponsiveness is the observation in the Dodge Report that university enrolment had shifted slightly toward "arts, education, and related disciplines" over the period 1960–77. In fact, arts and education were aggregated with science and a number of other unspecified faculties to obtain the shift from a 64 to 67 percent enrolment share. When arts is considered by itself there was a decline from 40 to 32 percent over this period. See Davies and MacDonald (1984,

pp. 141–43). This trend was not noted in the Dodge Report. See Canada, Department of Employment and Immigration (1981, p. 156).

9. These figures come from Statistics Canada, *Universities: Enrolment and Degrees*, Publication No. 81-204, various issues.

10. This restriction did not apply to the sizeable apprenticeship component of CMTP. In 1980–81 there were 58,194 apprentices who received training under CMTP. This represented 33.7 percent of the total full-time CMTP trainees. The total was composed both of those in pre-employment apprenticeship programs and apprentices with positions in firms but receiving classroom instruction under CMTP.

11. Whereas in 1970–71 a total of 97,136 trainees were enrolled in "basic educational upgrading" (apparently the same as BTSD), in 1975–76 the figure had dropped to 45,889, and by 1980–81 to 24,778 — although if the new categories "job readiness," "work adjustment," and "occupational orientation" are included with BTSD, the 1980–81 enrolment figure is 34,430. As a percent of total CMTP and CMITP full-time trainees, the decline is from 28.2 percent in 1970–71, to 19.4 percent in 1975–76, and to 9.7 percent in 1980–81 (13.4 percent including the extra categories). The number of institutional trainees fell from 319,971 in 1970–71 to 175,596 in 1975–76 and 172,550 in 1980–81. As a percent of total full-time CMTP and CMITP trainees, this represents a decline from 92.8 percent in 1970–71 to 74.1 percent in 1975–76 and 67.3 percent in 1980–81. See annual reports of the Canadian Employment and Immigration Commission (CEIC) — formerly the Department of Manpower and Immigration — for these data. Note that the 1970–71 figures do not distinguish between part-time and full-time trainees.

12. CMITP is now known as General Industrial Training (GIT). Under GIT up to 100 percent of direct training costs and some part of wages may be covered by CEIC, depending on the agreement negotiated with the particular employer. Rates of subsidy are higher for women being trained in non-traditional occupations, or for adults with "special needs." For women in non-traditional jobs, 75 percent of wages and 100 percent of direct training costs are paid for by CEIC.

13. There have been other initiatives as well. For example, the Economic Council of Canada (1982) notes that there has been much increased emphasis on vocational education in western Canada in recent years (see pp. 86–87). In Alberta enrolment in apprenticeship training nearly doubled in the five years prior to 1982.

14. See *Toronto Star*, "$1,000 Bonus Plan to Boost On-Job Training," September 19, 1983, p. 1.

15. The deficiencies of this approach are clear: the differential industry growth rates may well turn out to be incorrect and occupational structure is constantly changing. See Freeman (1980) and Selleck (1982) for discussion of the problems of review of the forecasting errors made by previous studies using these methods.

16. See Canada, Department of Employment and Immigration (1981, pp. 66–67). Projected excess demand in the higher skill trades over 1980–85 ranged from 40 percent to 67 percent of projected supply. For HQM, projected excess supply varied from 9 to 2 percent of total supply.

17. See Canada, Department of Employment and Immigration (1981, pp. 222–27). The British scheme failed to produce any perceptible increase in training, and led to many perceived inequities between firms. (For example, smaller firms with more stable work forces and fewer trainees and/or training programs too narrow to qualify for grants were net losers, while larger firms tended to be net gainers.)

18. See Canada, Department of Employment and Immigration (1981, pp. 165–66).

19. See Canada, Department of Employment and Immigration (1981, p. 172). Contributions to an RELP would be tax deductible and withdrawals would be tax free as long as spent on approved educational expenses. Thus the RELP is similar to Registered Home Ownership Savings Plan (RHOSP), under which withdrawals used for home purchase are tax free, rather than to a Registered Retirement Savings Plan (RRSP), under which withdrawals generally are taxable.

20. See Canada, Department of Employment and Immigration (1981, pp. 157–59).

21. In 1984 the government introduced Bill C-12, which would split the health and post-

secondary segments of EPF and subject the latter to a lower rate of growth (5 percent in per capita terms) for the next few years. See *University Affairs*, "Changes Due for EDF," April 1984, p. 9.

22. Recall the similar proposal in the Dodge Report — for "Registered Educational Leave Plans."
23. This proposal was made despite the disappointing experience with (and abandonment of) a levy-grant scheme in Britain, and the detailed criticism and rejection of such a scheme in the Dodge Report.
24. To some extent the failure of skill differentials to expand in what appear to be shortage occupations may be explained by changing age composition. An expanding occupation will see an increase in the employment share of young workers, whose wages are lower than average in the occupation. This will tend to depress the mean wage in the occupation, giving rise to the apparently paradoxical narrowing of skill differentials. Also, workers in shortage occupations may engage in increased on-the-job training. To the extent that this is paid for in the form of foregone earnings there is a further tendency for observed average wages in the shortage occupation to decline relative to those elsewhere. (See the discussion in this paper of how workers are believed to pay for part of on-the-job training in the form of lower wages.)
25. There had, of course, been important changes in the relative importance of the different programs, as discussed at the beginning of this paper.
26. This distinction was enunciated in Becker (1975, originally published in 1964). The following discussion follows Becker's analysis, which is conventional in labour economics. There appears to be some confusion of the terms "general" and "specific" in policy discussions. Some apparently regard training as general when the skills imparted (e.g., mathematical or reasoning ability) are useful in many different occupations, and as specific when the skills are useful in only a single occupation. For example, on this classification, typing would be thought of as specific since it is only used in secretarial work. However, in the labour economist's sense, typing is an example of training at its most general. Typing is used in almost every firm. Therefore, typing is far from specific (to a firm).
27. It is often argued that the government must intervene to support general OJT because the fact that firms do not earn a return on general training means they will only offer specific OJT. It is sometimes said that some firms "poach" on others by enticing away workers who have been trained in general skills at their employer's expense. This is a prime motivation for the suggestions for a levy-grant scheme (e.g., Canada, Department of Employment and Immigration 1981, p. 221). This argument neglects the fact that workers can pay for general training in the form of reduced wages, unless they are close to a wage floor set by minimum wage statute or inappropriate collective bargaining.
28. For an examination of precisely how costs and returns might be shared see Hashimoto (1981).
29. Under the ideal conditions posited here, adjustment can only be speeded up by lowering private costs, such as through subsidies. But this will lead individuals to invest in too much training — at the margin, social costs will exceed benefits. Adjustment takes place too rapidly.
30. Under the full insurance markets assumed in the ideal world of this section, displaced workers would not suffer since they would have been fully insured against unemployment. Thus, distributional implications of doing nothing to help, say, older displaced workers would be very different from under real-world conditions. Note, however, that when we move to the real world, where private unemployment insurance may be absent, government intervention to encourage unprofitable retraining is still wasteful from a pure efficiency point of view. If the government wishes to alleviate income-loss under these circumstances, it would be more efficient to do so via cash compensation than by sponsoring retraining.
31. This contrast between a desire for increased government intervention in education and training and less elsewhere is currently being observed outside of Canada as well. A particularly striking instance is provided in the United Kingdom, where the Thatcher

government has greatly increased expenditures on training, introducing a universal program for school-leavers, at the same time that considerably reduced government intervention is the goal elsewhere. See Ryan (1984).

32. For an excellent survey of possible rationales for government intervention see Gunderson (1974).
33. Presumably, if research output is easy to measure, direct subsidies to research would be preferable. Methods of subsidizing research directly to a greater extent have received some recent attention. See, for example, Leslie (1980, pp. 351–58) and Commission on the Future Development of the Universities of Ontario (1984, Section 6-2).
34. It is sometimes argued that the existence of a highly skilled labour force benefits society at large, implying an unspecified externality and a justification for government intervention (e.g., Economic Council of Canada, 1982, p. 80). Such an externality may arise under the welfare state because the community shares in the higher income of more skilled workers via taxation. However, in competitive markets, workers (together with firms in the case of specific training) internalize the benefits of training. There is no spinoff to others at the margin, and so decisions on education and training correct from a societal point of view will be made by private agents.
35. It may be argued that, in some cases, the problem is not one of adverse selection and moral hazard, but of insufficient information about market demand. For example, if a dentist were insured against a decline in demand for dentists' services, his individual behaviour could not affect payment by the insurance company, so moral hazard and adverse selection would not be present. However, unless reliable objective information on the state of demand for dentists' services is available, the insurance still may not be offered. Government intervention to increase the availability of such information might be advanced.
36. Increased future tax revenue as an externality of education is discussed later in this paper. The argument given here may not go through if the tax system encourages too much investment in human, relative to physical, capital.
37. Levhari and Weiss (1974) demonstrate that both these propositions are true under plausible assumptions. Note that the policy relevance of these points is not as direct as we might like. In the real world, adverse selection is present. This may mean that with government-provided loans, but without insurance, some students (i.e., those with a high risk of default) may be getting too much education from an efficiency standpoint.
38. Individuals can diversify their human capital investments to some extent as investors do their portfolios, although the scope for this is clearly less in the case of human capital. Some insurance appears to be provided by firms, which may employ incentive mechanisms for workers which dampen differences across workers in luck and ability (e.g., Lazear and Rosen, 1981). Also, the problem is reduced somewhat by the self-selection of less risk-averse individuals into more risky occupations. Finally, note that in a world with government, the tax-transfer system considerably reduces risk. If one's wage is unexpectedly high, the government shares the good fortune via taxation, while if one's human capital is wiped out, income maintenance payments soften the blow. This reduces the need for additional measures to reduce risk in human capital investment.
39. Like some other schemes proposed by Friedman (e.g., negative income tax), the income-contingent loan scheme has been embraced by a wide spectrum of both "liberal" and "conservative" economists. See, for example, Vickrey (1962), Panel on Educational Innovation (1967), and Shell et al. (1968) in the United States; and Bird (1976), Stager (1981), and Kesselman (1983) in Canada. For a discussion of some of the difficulties with the proposal see Nerlove (1975).
40. Despite the wide publicity accorded to, for example, microcomputers and robots, it is not clear that an acceleration of technological change has occurred for the economy as a whole, whatever may be expected to happen in the future. There is some evidence, however, of a significant increase in the trend rate of growth of labour productivity in the United States over the period 1980–83 (see Baily, 1984), which might be a reflection of more rapid technological change.

41. See Akerlof (1970) and Leland (1979) for analysis of the lemons phenomenon.
42. It may be that efficient scale here is not as large as one might believe. The fact that our universities and colleges are typically very large may be the result of government policy rather than technology. Also note that increasing use of computer-assisted learning may in the future reduce further the minimum efficient scale of post-secondary institutions.
43. Unions might be much less prevalent in the absence of government. They appear to owe at least part of their current importance to government regulation of certification and collective bargaining procedures.
44. See, for example, Duncan and Stafford (1980), and Mincer (1981). Simpson (1983), however, finds an insignificant positive effect of unionization on training in Canada (see p. 59).
45. See, for example, Simpson (1983, p. 32).
46. See Coyte (1983).
47. Rees (1977, p. 130) says: "The workers and their unions regard the right to a job as a property right, not to be infringed without compensation. If a diesel fireman is no longer needed, this is no fault of the man who began his career in good faith as a coal-shovelling fireman. . . . Although his conception may have no legal foundation, management in practice may be forced to accept it and to make concessions . . . there will usually be some terms on which both parties feel the new situation to be better than the old."
48. Union workers' rents equal the excess of their wages over what they could earn elsewhere (or the possible value of leisure and home production). Full compensation for job loss equals the value of these rents. Thus, a technological change which would reduce total costs by a small amount, but make a significant number of union workers redundant, may not be introduced since the severance pay required to gain union acquiescence may exceed the cost reduction. From the social point of view this is not a matter of concern, however. To see this, note that in a competitive spot market for labour, the workers would earn a wage equal to the value of their alternative activities — that is, the true (social) cost of their time. But, if they were paid this wage, the technological change described would not be introduced. (The cost saving would become negative because, by laying off workers, the amount saved would now equal the competitive wage rather than the higher union wage.) Hence a technological change may appear attractive from the point of view of a firm using union labour when, on a correct accounting of social costs, the change is actually unattractive.
49. While "buy-out" agreements have been common in North America in industries such as construction, printing, and transportation that are dominated by craft unions, they have been much less common where industrial unions prevail — for example, in manufacturing (see Addison and Siebert, 1979, p. 324). Whether this indicates the likelihood of special difficulties in introducing new technologies in manufacturing is an interesting question, but one which cannot be addressed here.
50. This is an example of a "transfer externality." Such externalities, which would not exist in the absence of government, are quite distinct from the "real externalities" that economists are more often concerned with, such as failure and a primary rationale for government intervention.
51. See Davies and MacDonald (1984, chaps. 2 and 3), for an exposition and comparison of signalling, human capital, and information investment models of education. Davies and MacDonald argue that much education which appears unproductive, and is widely believed only explainable in terms of signalling, may actually be highly productive since it allows individuals to explore their interests and abilities and leads to better matching of workers to occupations and jobs.
52. The effects of vocational training on unemployment and poverty may be relatively short term if occupational and skill demand conditions change markedly over time, as widely believed. University education may have a greater long-term effect as a result of providing a broader education which allows an individual to adapt more readily to change. See Globerman (1985) for evidence on the relative adaptability of the more- and less-educated to technical change.

53. Alternatively, the same result goes through if direct costs such as tuition and books are tax deductible.
54. Boskin conjectured that the overall tax system in the United States discouraged physical investment more than human investment (see Boskin, 1975, p. 194). Recent research suggests that the burden of capital income taxation may in fact be considerably lighter than it was earlier thought to be, however (see Fullerton and Henderson, 1984).
55. At one extreme, the resources that will be invested could be fixed, so that symmetric taxes on both forms of investment would not lead to any welfare cost or distortion. However, if one form of investment received lighter treatment, too much of the fixed investment resources would be directed to this form of investment, producing a distortion.
56. That is, if foregone earnings are small, the worker will not usually move to a lower tax bracket.
57. Training specific to the individual firm is less useful for women than for men if women spend significant periods out of the labour force, or move several times over the life cycle to accompany their husbands to new locations where the husband's earnings opportunities are improved. Both phenomena break the association with an individual employer, and therefore make general rather than specific training a better investment.
58. This is true not only for general training, but for specific as well, since the worker must pay for part of specific training. In the specific case, however, the effect is less severe since the employer bears part of the cost of training.
59. See Hasimoto (1982, p. 1083) for a summary of other recent evidence of a minimum-wage effect on training. Simpson (1983, p. 49) finds a negative, but insignificant, effect of the minimum wage on training in Canada.
60. See Gunderson (1981, p. 26) for a survey of evidence on the youth employment effects of minimum wages.
61. It has been argued that by enforcing low wages at least in the first year or two, apprenticeship regulations produce more training than would otherwise occur in unionized firms (see Simpson, 1983, pp. 26–27). I am not aware of any empirical evidence relevant to this conjecture.
62. This is not as effective as one might suppose. For example, in Ontario, although "separate parents" may send their children to public schools without paying fees, "non-separate parents" must pay not only ordinary school support taxes but fees to the separate school board if they want to send their children to separate schools. Since the separate schools enjoy considerable respect for their attention to "basics," the number of parents who elect to incur this additional expense is apparently not negligible.
63. Class size may have little effect on the quality of lecturing — whether there are 100 or 400 students in the hall makes little difference to individual attention. However, the quality of other crucial inputs — for example, evaluation of students' work, and tutorials — may be very sensitive to class size. For a vigorous argument that the quality of instruction in many university faculties is too low see Light (1984).
64. Considerable effort was devoted by economists in the 1960s and 1970s to the estimation of rates of return to education (see Stager, 1981, and Davies and MacDonald, 1984, pp. 85–86). The purpose was largely to see whether there was overall under- or overinvestment in education. Such studies typically suggest that the rate of return to education is quite high — for example, between 10 to 15 percent, although a decline in rates of return is believed to have occurred in the 1970s. While such estimates had a considerable impact in the 1960s, their influence waned in the 1970s along with decreased public enthusiasm for government support for post-secondary education.
65. See Axelrod (1982, pp. 22–28) for a discussion of attitudes in the 1950s and early 1960s.
66. If the policy changes recommended later in this section were adopted — for example, higher and more flexible tuition fees together with increased student aid — a considerable increase in quality of education might be achieved without an increase in government expenditure, or indeed despite a decline. See discussion near the end of this paper.

67. See Canada, Department of Employment and Immigration (1983c), Selleck (1983, pp. 9–12), and Kaliski (1985).

68. This point is reinforced by the observation that the requirement for certain kinds of designers and implementers of new technology may decline considerably in relative importance. The "fifth generation" of computers, for example, will economize on programmer inputs by using higher level languages — in effect increasing the extent to which a computer "programs itself."

69. Note that, as has frequently been pointed out, some of these areas –– for example, office work, financial services, and trade — have large concentrations of female workers. This creates a fear that the dislocations of the new technology will impinge disproportionately on women, and particularly lower-paid women. The severity of this problem is not yet fully apparent, although there is some preliminary evidence (see Selleck, 1983, p. 5).

70. A recent U.S. Bureau of Labor Statistics projection of manpower requirements in the United States to 1990 found that occupations likely to experience the highest growth *rates* of employment to 1990 included data processing machine mechanic, computer systems analyst and computer operator. Such occupations start from a relatively small employment base, however. Hence the bulk of employment growth is likely to occur in occupations such as janitor, nurse's aide, sales clerk, waiter/waitress, professional nurse, food preparation worker, secretary and truck driver. (These are among the top 20 occupations according to the absolute size of expected employment increase.) See Carey (1981, p. 48).

71. These schemes include the recently introduced Youth Training Scheme in the United Kingdom which aims to guarantee every school-leaver with a year of mixed on-the-job and institutional vocational training (see Ryan, 1984).

72. A precedent for this type of scheme is provided by the employment tax credit introduced into the corporate tax in 1978 (initially for three years but later extended). This credit provided a $1.50 per hour wage subsidy (higher in designated areas) for new employees hired on a full-time basis for at least three months.

73. It may not be possible to split up time on the job into "work time" and "training time." In that case "half-time in training" should be interpreted as receiving a training component on the job sufficient to reduce output from $4.00 per hour to $2.00. (I assume an element of training is inescapable.)

74. While wage subsidies provide "room" for more training, it might seem that employers would have little incentive to offer additional training. Under competitive conditions, they do have an incentive. In the example discussed, if the employer would not allow the workers half-time training after the subsidy had been introduced, another employer in the same line of business could make a profit by offering jobs with a higher training content. He might, for example, be able to attract employees on the basis of one-third time training (output = $2.67 per hour) and a wage equal to the minimum of $3.00. In this case, a net payment for labour of $2.00 per hour would again be made by the employer, and profit of $.67 per hour would be earned. Competition would bid away these profits. In the example, the amount of training an employer would have to offer to attract a young worker with the characteristics outlined would increase until half-time training was being allowed.

75. The term "prime age" is usually used to refer to workers in the middle age brackets — say aged 25 to 55.

76. It is sometimes claimed that such schemes are unattractive for distributional reasons, since instead of everyone attending a "uniform" public school system and getting an equal start, the children of higher income groups will go to superior, private schools. In rebuttal, it has been argued that, on average, the poor now attend the worst public schools (see West, 1981). It is in these schools, rather than those attended by higher income groups, that the most significant improvements in the quality of education probably would be induced by the voucher or tax credit scheme.

77. Over the period 1984–94 the university-age population (18 to 24) in Canada is projected to decline by about 20 percent (see Leslie, 1980, p. 34). It has been argued that this may not produce a decline in enrolment if the current trends toward higher participation rates — especially among women — and more part-time and graduate enrolment

continue (see Foot, 1984). University enrolment demand is, however, notoriously difficult to predict. Some decline in overall enrolment may well occur.

78. Of course, not all finance should be related to enrolment. The universities, in particular, function as research as well as teaching institutions. As discussed earlier, it appears desirable to separate finance for research from support for the instructional role, if possible. Such a separation would provide some of the stability in university finance desired by academics.

79. It has been pointed out that Canada does not have any universities approaching the eminence of the outstanding private American schools (Harvard, Chicago, Yale, for example). This may in part be due to the inability of any Canadian institution to levy the sizeable fees charged by these universities.

    Note also the income distribution consequences of greater quality differentials. Top students would be better trained, tending to produce greater inequality in lifetime earnings. It can be argued, however, that even middle- and low-ranking students would get a much better education under conditions more closely approximating a free market. The net impact on inequality is therefore unclear. (Also, it could be argued that we have a tax-transfer system to take care of economic inequality. Continuing with the present approach might be seen as an attempt to achieve greater equality by imposing general mediocrity.)

80. The view is frequently expressed that students are typically insufficiently well informed to be allowed to determine the allocation of educational resources in this way. In fact, there is considerable evidence that post-secondary students are well-informed about demand conditions, job prospects, and many other labour market characteristics. See Davies and MacDonald (1984, p. 76).

81. See, for example, the response to the Kesselman (1983) proposal in "Lifelong 'Mortgages' Would Finance Varsity Fees," *The Province*, Nov. 8, 1983, p. 13.

82. A special problem is created by the fact that some graduates will spend many adult years working in the home. A disproportionate burden would therefore be levied on graduates participating in the labour force, unless special arrangements (themselves likely unpopular in certain quarters) were made to collect repayments from those with little taxable income because of non-participation in the labour force.

83. Costs of institutional vocational training (other than those covered under present manpower training programs) would be eligible for this tax credit.

84. The degree of offset demands on the fraction of tuition allowed as a federal tax credit, and the impact of the tax credit ceiling.

85. There is an element of subsidy involved in the CSLP. Interest is paid by the government while students are still in school, and interest rates do not cover the expense of default.

86. There are also some features of the tax system which may somewhat discourage general on-the-job training relative to specific training.

87. This proposal would not have economic effects similar to those of the levy-grant scheme, since it would not directly impose additional costs on employers. Employers would be compensated for the costs of hiring replacements via tax credits.

88. From an efficiency point of view, it might be preferable to provide all support for vocational retraining via RELSPs and terminate the current high rates of subsidy under manpower training. Manpower trainees receive free tuition and generous training allowances, so that their total training costs are subsidized at a very high rate. The result, predictably, is excess demand for manpower training, and rationing of training places. If RELSPs and the educational expense tax credit were the sole means used to support manpower training, we would expect some who can genuinely benefit to take extended retraining while some who would like to participate in conventional manpower training would find that, when forced to bear a large portion of the costs themselves, the investment was not worth making.

89. In the typical situation, with real earnings rising, the subsidy rate would actually be too low. This should not be a serious problem.

90. Greater relief would be provided to persons whose reeducation proved to be more productive. This is because future tax relief is proportional to marginal tax rates, and

these rise with income. Thus RELSP debt repayments according to this scheme would have the opposite of the often advocated income-contingent repayment feature. Instead of net repayments increasing with income, they would actually decline. For this reason, it would probably not be advisable to use RELSP debt as a replacement for CSLP for those entering the post-secondary sector directly from high school. Also, tax relief on repayments might be related to the taxpayer's marginal tax rate at the time of returning to school.

91. In the terminology of human capital theory, "potential earnings" represent the amount one could earn by devoting all time spent learning and earning exclusively to earning. That is, potential earnings represent the maximum one could earn without increasing hours.

92. Note that not all displaced older workers will be in this category.

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